OCTOBER, 1960

Plant Engineering®

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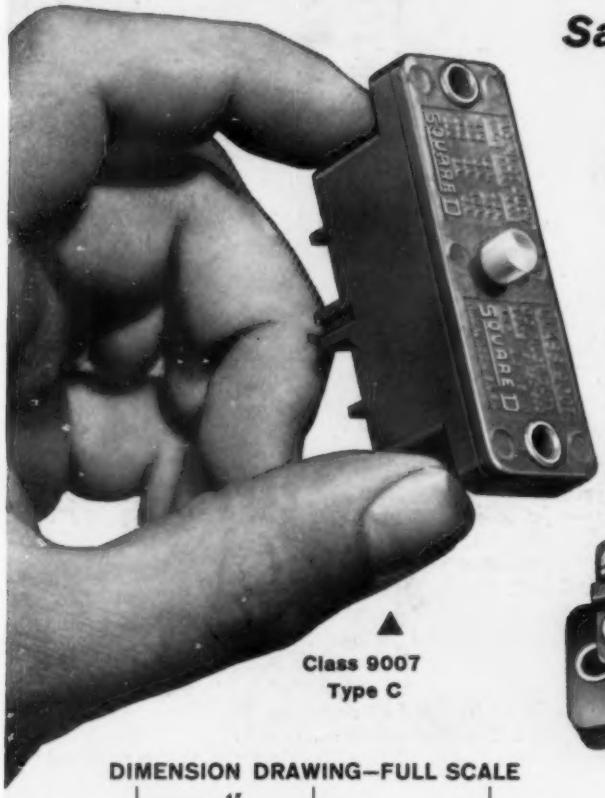
The magazine that helps **plant** engineers with their everyday problems

Volume 14, No. 10 Circulation of this issue 51,930

Now!..

SQUARE D PRECISION *SNAP* SWITCH AVAILABLE WITH 2 POLES!



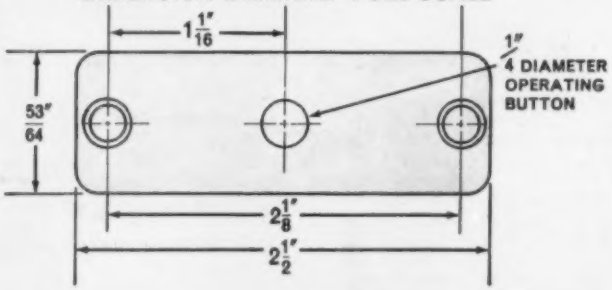
▲ Class 9007
Type C

Same size and mounting as single-pole switch

Here's a precision snap switch which combines 2-pole versatility with high electrical ratings—and takes no more space than a single-pole switch!

The new switch is available either single-throw (2 normally open or 2 normally closed) or double-throw, and like the single-pole switch, it features: double-break contacts—large screw-type terminals—strong melamine case—simplified mounting...a design which assures reliability, precise repeat accuracy and long mechanical life.

DIMENSION DRAWING—FULL SCALE



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SQUARE D COMPANY

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Plexiglas glazing could have prevented this replacement cost!

The high cost of replacing broken windows can be reduced sharply by installing PLEXIGLAS® acrylic plastic glazing. This breakage-resistant material takes the hazard out of your windows, transoms, doors, skylights and partitions. Install PLEXIGLAS and watch costs come down while safety goes up. Call your nearest Authorized PLEXIGLAS Distributor for advice and service on crystal clear or tinted and translucent colored sheets. He is listed under PLEXIGLAS in the Plastics section of telephone directories in major cities.

Chemicals for Industry

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'ROUND ABOUT

with the editors in field and office

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Industrial Building Conference

THE MOST extensive conference ever arranged on construction of new industrial buildings and modernization of old ones will take place in New York, December 12 through the 15. The conference will be a feature of the first Industrial Building Exposition and Congress which will take place at the New York Coliseum.

Nineteen basic topics dealing with virtually every major aspect of new construction and modernization are scheduled. Discussions will involve: types of plants to meet specific needs, financing, modernization and expansion, minimizing disruption, site selection, trends in plant design, dealing with community officials, employee services, prefabricated components, advances in the use of concrete, plastics in construction, and many other phases of industrial buildings.

For more information about this conference and show or if you wish to receive advance registration cards, send your request to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

Director of Building Services

Philip A. Toll has been appointed to the new position of director of building services for Sperry Gyroscope Company, Great Neck, New York. He will be responsible for construction, plant engineering and other services at more than 10 Sperry plant facilities.

He joined the company in 1951 and has served in various manufacturing posts. In 1955 he was appointed manager of data processing and directed installation and operation of the company's central data processing facilities, including the Univac I and II large-scale electronic computers and a new Univac high-speed, solid-state computer at the company headquarters plant in Great Neck, N.Y.

Charts Compare State Safety Codes on Ladders

COMPARATIVE STANDINGS of the 50 states with regard to their regulations safeguarding workers on demolition projects and on jobs requiring the use of ladders are shown by two charts released by the Bureau of Labor Standards.

Here are just a few of the facts brought out in the charts: 17 states, including several highly industrialized ones, have no codes safeguarding ladders used by construction workers; half of the states do not have codes protecting employees in demolition work.

A half-dozen states have demolition codes identical with or very similar to the ASA standard, while eight states have ladder codes which correspond with ASA provisions. Other states, according to the charts, have varying requirements—some more, some less restrictive than the ASA standards.

Copies of the charts may be obtained, so long as the supply lasts, from the Bureau of Labor Standards, U.S. Department of Labor, Washington 25, D. C.

Engineering Appointments

AT THE END of 1960, **Ed Flug** will retire from the Simmons Company, Munster, Ind., after 50 years in the mechanical and engineering division.

Norman C. Russell has been appointed to succeed him and will be in charge of all the company equipment and facilities nationally. He will move to the National Technological Center at Munster after relinquishing his Atlantic Division duties to **Ralph Johnson** who will succeed him at Elizabeth, N. J.

During the remainder of 1960, Flug and Russell will make a number of trips together to the various plants. With the beginning of 1961, Mr. Russell will assume full supervisory responsibilities for all plant buildings and facilities, equipment procurement and maintenance standards.

Plant Engineer Is Co-Chairman Of Material Handling Conference

CHARLES C. BASSETT, plant engineer for the Belknap Hardware and Manufacturing Company, Louisville, Kentucky, has been named co-chairman for the technical conferences that will be held in conjunction with The Ma-

Subscriptions: U.S.A. $10, Canada $11. Other countries $12 per year. Single copies $1. Change of address: Send to PLANT ENGINEERING, Circulation Division, Barrington, Illinois. Please supply position title, company name, company address. Request must reach us by the 15th of month to make the change effective with following month's issue. Published monthly and accepted as controlled circulation publication at Chicago, Ill.

BPA

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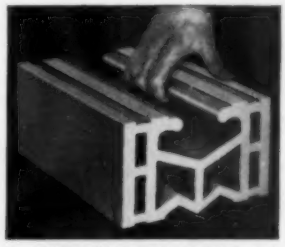
CONSTRUCTION AND MAINTENANCE COSTS ARE LOW WITH NATCO DRI-SPEEDWALL TILE

Structural clay tile walls of Natco Dri-Speedwall Tile are erected 15 to 30 per cent more quickly and easily than walls of ordinary masonry materials because each unit has smooth, built-in "speed handles." This enables each unit to be picked up and laid with one hand—leaving the other hand free to work the trowel and mortar. This reduction in labor time results in lower construction costs.

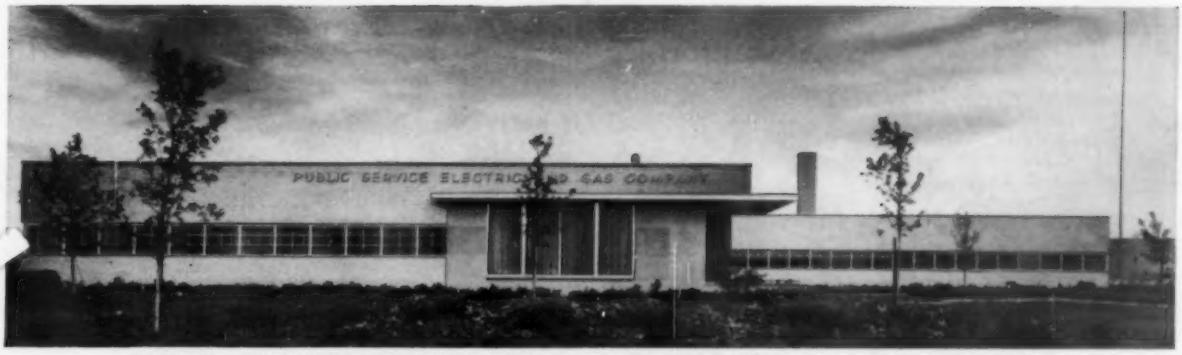
Maintenance costs of fireproof Natco Dri-Speedwall Tile are an absolute minimum. Colors and finishes are as permanent as the tile itself. Walls require no painting or repairs . . . cannot rot, decay, shrink or crack. Smooth finishes are easily cleaned and stay clean longer.

Loadbearing Dri-Speedwall Tile is available in smooth unglazed buff or manganese spot and wire-cut textured red shale or salt glazed.

For complete information write for catalog Dri-18D.



8" x 5⅓" x 12" (nominal) Dri-Speedwall Tile unit showing built-in "speed handles" for fast and easy handling. Universal 4" x 5⅓" x 12" fittings units are also available for corners, jambs, sills, etc. Can be easily cut on the job for required short lengths.



Exterior view of the Public Service & Electric Company's new office and storage building in Moorestown, New Jersey, showing walls of Natco buff, unglazed Dri-Speedwall Tile. Other Natco building products were used extensively inside the building.

NATCO CORPORATION

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An inadequate or unsuitable coupling causes wear and damage to your machines — resulting in high maintenance costs and costly shut-downs.

Eliminate these coupling-caused headaches.

The high degree of accuracy, reliability and performance make Thomas "All-Metal" Flexible Couplings the best in the world.

They will protect your equipment and help to extend the life of your machines.

UNDER LOAD and MISALIGNMENT only THOMAS FLEXIBLE COUPLINGS offer all these advantages:

- Freedom from Backlash
- Torsional Rigidity
- Free End Float
- Smooth Continuous Drive with Constant Rotational Velocity
- Visual Inspection While in Operation
- Original Balance for Life
- Unaffected by High or Low Temperatures
- No Lubrication
- No Wearing Parts
- No Maintenance

Write for our New Engineering Catalog 60

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

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'ROUND ABOUT

terial Handling Institute Central States Show.

Both events will be held in the Kentucky Fair and Exposition Center, Louisville, November 1 through the 3.

The duties of the general chairman will now be shared by Mr. Bassett and Mr. Klinstiver, who is associated with the Falls Cities Transfer and Storage Company, Jeffersonville, Indiana.

Technical conferences to be conducted on each of the three days will interpret new and improved methods of industrial material handling and protective packaging. "Progress Through Knowledge" is the central theme of these conferences that will be geared to the interests of industrialists throughout the Central States area.

If you would like more information about the conference or show, write to Hanson & Shea, Inc., One Gateway Center, Pittsburgh 22, Pa.

How To Control Pests

METHODS TO control the resistant German roach, and proper techniques for safe handling of new insecticides, will be featured at the Special Course in Sanitation to be given October 31 to November 5 at the American Institute of Baking, Chicago, Illinois.

Participants in the sanitation course will be instructed on the safe use of the new insecticide products by minimizing contact between operator and insecticide. Sessions will cover control of all types of insects, rodents, foreign material; techniques for cleaning, floor maintenance, and safety in sanitation; control of mold and prevention of food poisoning; and new and modified equipment to meet modern sanitation standards.

Complete programs and applications may be obtained by writing to Department of Bakery Sanitation, American Institute of Baking, 400 E. Ontario St., Chicago 11, Illinois.

Director of Plant Engineering

Arthur C. Smith has been appointed a vice president and director of plant engineering of the Johns-Manville Products Corporation. In his new post he will be responsible for the company's plant engineering program and will guide the company's two major engineering departments at Manville, N. J., and Waukegan, Illinois.

He began his career with the company in 1940 as assistant plant engineer at the Waukegan, Illinois, plant. His broad plant engineering background includes a wide range of assignments as project engineer on important construction activities and serving as building products division production engineer, supervising an extensive program of plant improvement, cost reduction and plant expansion. He was appointed chief plant engineer in 1954.

A native of Chicago, he graduated from Northwestern University with a degree in mechanical and electrical engineering.

Investment Casting Clinic

IF YOU ARE looking for a better method for producing your small components, then bring your metal fabrication problem to the Investment Casting Clinic. The clinic will be held at the North Park Hotel, Chicago, on November 1.

The Chicago clinic will be a full day session featuring workshop discussions on special investment casting displays. During the workshops, participants will have an opportunity to discuss pertinent questions with qualified technical personnel from the investment casting industry.

Further information on this clinic may be obtained from the Investment Casting Clinic, 27 E. Monroe St., Chicago 3, Illinois.

Building Materials Conference

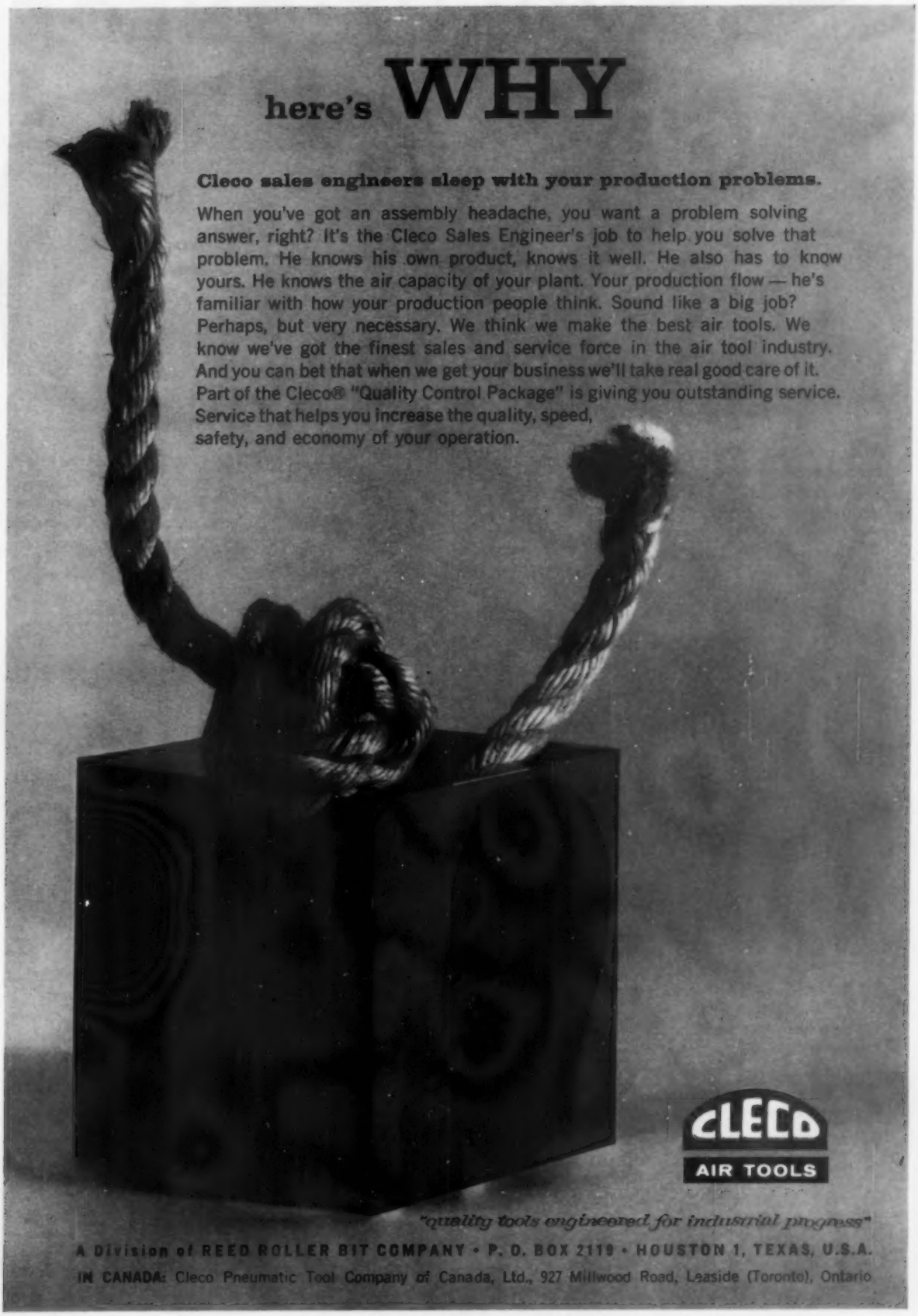
AS ONE OF the four major subjects for its 1960 Fall Conferences, the Building Research Institute will stage a meeting on "Structural Foams" on the first day of the three-day gathering at the Shoreham Hotel, Washington, D. C., November 15 through the 17.

The conference will be divided into two sections, one to examine uses of foamed inorganic materials such as glass, concrete and metals, and one to discuss organic foams, including the polyurethanes and polystyrenes.

Various applications of foamed concrete in roof slabs, floor slabs and walls will be discussed, as well as an examination of further applications of foamed metals in building construction. In addition new uses of foamed glass for acoustical purposes and applications of this material for thermal insulation will be presented.

Other conferences scheduled during this three-day period will be concerned with Preassembled Components, Fasteners for Industrial Curtain Walls, and a Roundup of New Building Research.

Complete information and registration material may be obtained from Harold Horowitz, Assistant Director for Technical Programs, Building Research Institute, 2101 Constitution Ave., N. W., Washington 25, D. C.


here's WHY
Cleco sales engineers sleep with your production problems.
When you've got an assembly headache, you want a problem solving answer, right? It's the Cleco Sales Engineer's job to help you solve that problem. He knows his own product, knows it well. He also has to know yours. He knows the air capacity of your plant. Your production flow — he's familiar with how your production people think. Sound like a big job? Perhaps, but very necessary. We think we make the best air tools. We know we've got the finest sales and service force in the air tool industry. And you can bet that when we get your business we'll take real good care of it. Part of the Cleco® "Quality Control Package" is giving you outstanding service. Service that helps you increase the quality, speed, safety, and economy of your operation.
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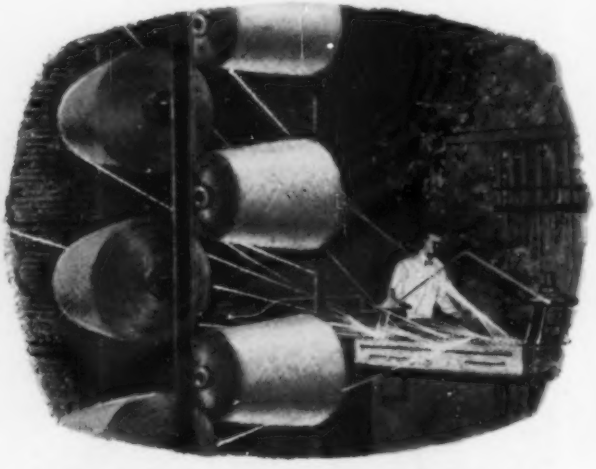
GOODYEAR EVOLUTION OF

IT ALL STARTED when Leonardo da Vinci invented the belt drive for his polishing wheel. Spurred on by the drive's many advantages, engineers have striven for a more effective method of indirect power transmission ever since.

THE NEXT MAJOR DEVELOPMENT, although then seemingly unrelated, was the discovery of the vulcanization of rubber in 1839. Charles Goodyear not only fathered a multibillion-dollar industry, but also helped pave the way to much more efficient power transmission.

ANOTHER MAJOR BREAKTHROUGH came in 1941, when Goodyear introduced the first practical Steel Cable V-Belt for use on Army tanks. Here was the strongest, most efficient, most heat- and stretch-resistant belt ever built. A wartime success, steel cable is used in belts handling today's toughest industrial drives.

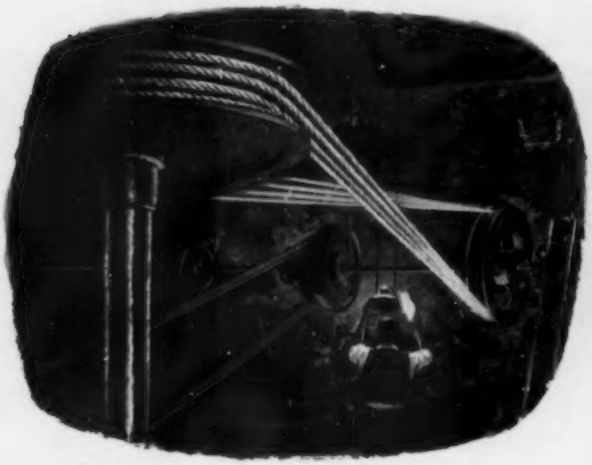


THEN CAME THE "MIRACLE" FIBERS and super-rated V-belts. Again Goodyear was in the fore with the HY-T V-Belt—a strong, shock-resistant belt that answered most multiple drive problems. But V-belt makers still sought a more effective way to overcome stretch and shrinkage.

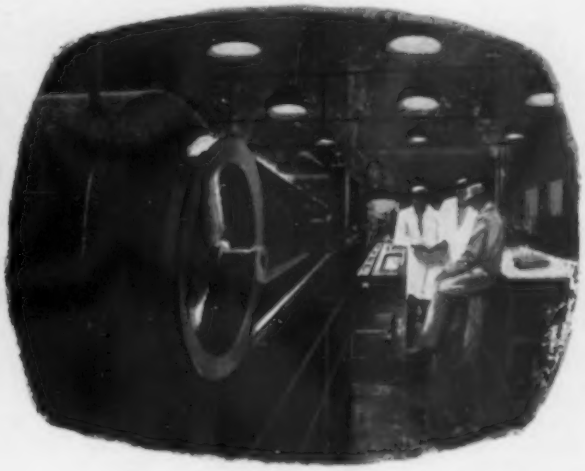
For maximum, trouble-free horsepower hours on any V-belt drive, insist on the top belt from the top beltmaker.

Lots of good things come from GOOD

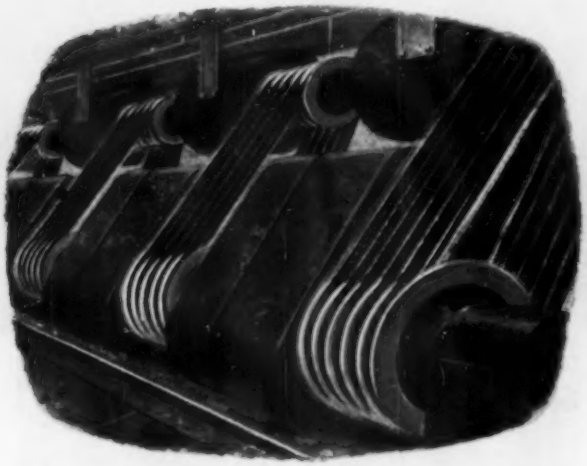
A REVOLUTION



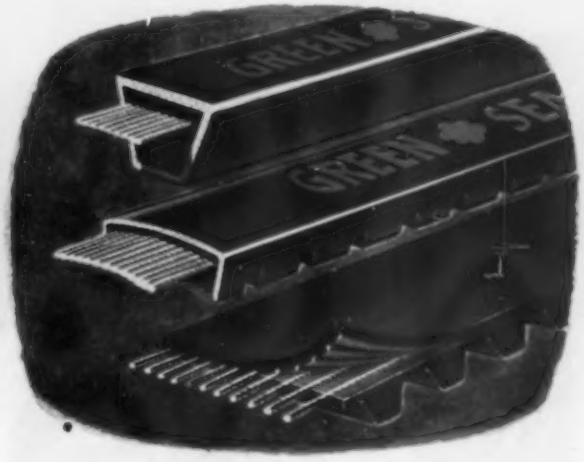
OVER A DECADE PASSED BEFORE a man named Combe introduced two new ideas in the transmission of power—teams of load-carriers and "wedge-in" action. His first multiple rope drive was not very efficient or durable, but started a whole new trend in development.



IT TOOK A LITTLE TIME before the first rubberized V-belts were introduced. Many of the earliest improvements were developed by Goodyear scientists. The greater efficiency of the V-belt soon placed it on many drives, despite shortcomings in length stability and strength.



GOODYEAR SOLVED THE PROBLEM with the 3-T Process to take surplus shrinkage and stretch out of synthetic cord. That development made possible multiple drive V-belts with true dimensional stability—Green Seal V-Belts by Goodyear that stayed matched on the drive or in storage.



A REVOLUTION IN POWER TRANSMISSION was launched by the complete line of V-belts with the Green Seal—Compass-V-Steel, HY-T, E-C Cord, and the compact new HY-T WEDGE. With P.D. (positive drive) and Variable Speed Belts, they combine to offer Goodyear belts of unsurpassed quality for every need.

See your Goodyear Distributor or write: Goodyear, Industrial Products Division, Lincoln 2, Nebraska, or Akron 16, Ohio.

YEAR THE GREATEST NAME IN RUBBER

HY-T, Green Seal, E-C, Compass, P.D.-T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

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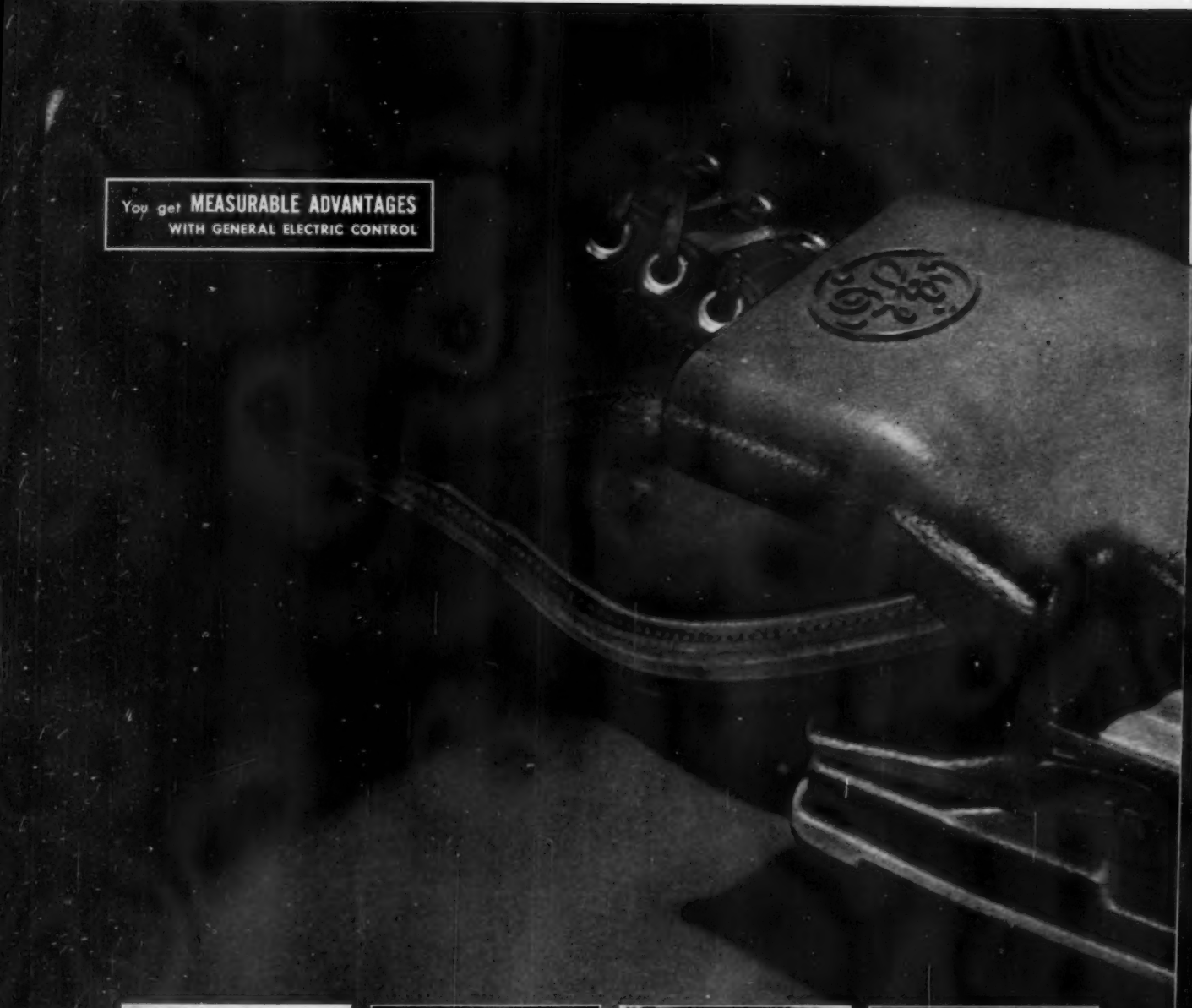
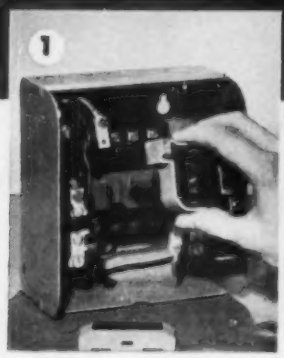
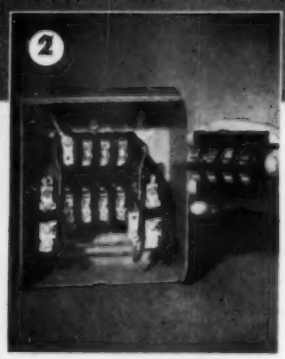
You get **MEASURABLE ADVANTAGES** WITH GENERAL ELECTRIC CONTROL







HOW GENERAL ELECTRIC STARTER BENEFITS ADD TO SAVINGS

1. **25-SECOND COIL CHANGE**—Without tools, without removing wiring, you can change a coil on a General Electric magnetic starter to meet different application requirements.
2. **10-SECOND CONTACT INSPECTION**—Just lift off coil spring clamps, remove entire magnet and movable contact assembly. No tools needed, no wiring to remove.
3. **ADJUSTABLE OVERLOAD SETTING**—A handy knob adjusts the nominal heater rating ±15% to meet special applications. No need to change or reposition heater.
4. **VARIETY OF MODIFICATION KITS**—Seven G-E modification kits—including push button, selector switch, and indicating light—meet wide variety of application needs with minimum stock.
5. **PLUG-IN HEATER FOR CR101 MANUAL STARTER** is offered only by General Electric. Plugs in from front in seconds; can't be installed the wrong way.

With all General Electric Controls:

LITTLE CONVENIENCES ADD UP TO BIG COST SAVINGS

This foot switch doesn't skid unintentionally. A small convenience? Perhaps. But when you consider that the operator doesn't have to continually reposition the switch, you have a measurable advantage which could add up to a big cost savings for you. All General Electric General Purpose Control devices offer measurable conveniences. Other devices, like size 0, 1, and 2 starters, offer coil change in 25 seconds . . . without tools . . . without changing wiring. Time to inspect contacts: 10 seconds! And a twist of the wrist adjusts overload settings. Plus a wide variety of easily installed G-E starter modification kits cuts stocks to a minimum. Just pick your G-E control device and there's a convenience you can measure.

Generally, conveniences don't become important —or measured—until they are missed. Why wait. Call your General Electric representative now for details or write for Bulletins GEA-7086 on Foot Switches, GEA-7020 on Magnetic Starters, GEA-6358 on Manual Starters. Let G-E control conveniences and proved quality performance add up big cost savings for you. General Electric Company, Schenectady 5, N. Y. 813-26

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 507 on Reply Card

NEW RAPISTAN APC® CONVEYORS SERVE WHOLESALERS, RETAILERS, INDUSTRY

A FINGER'S TOUCH

Industrial applications of Rapistan APC equipment include this wheel-type conveyor that moves freshly packed butter from the packaging area into the cooler. Orderly accumulation of cartons permits intermittent unloading under uncomfortable low-temperature conditions in the cooler.

Cartons are stopped without stopping the APC live-roller conveyor, a feature which makes APC an ideally suited conveyor for filling and packing operations involving accumulation of large, heavy items. In this situation, cartons are loaded and packed right on the conveyor line.

accumulates packages with no pressure build-up!

And when you release your finger, only the first carton moves . . . then the next . . . etc. This is SINGULATION, another exclusive Rapistan APC (Adjustable Pressure) Conveyor feature providing much lower power requirements and longer belt life. Combined with low-pressure accumulation under power, the result is a conveyor that safely handles any mixture of carton and container sizes and shapes. Fragile materials can share the ride with heavy, bulky materials without harm. Complete safety is assured for operating personnel, containers and contents. Production and handling efficiency and low-cost operation result. Detailed information on how Rapistan APC Conveyor, both wheel and live-roller types, are benefitting every type and variety of industrial, service and distribution operation is available for the asking.

Rapistan APC (Adjustable Pressure) Conveyor plays an important part in the distribution of incoming merchandise in this department store. Accumulation, checking and sorting processes are served with exceptional efficiency in distributing goods to marking and sales storage areas in the large store.

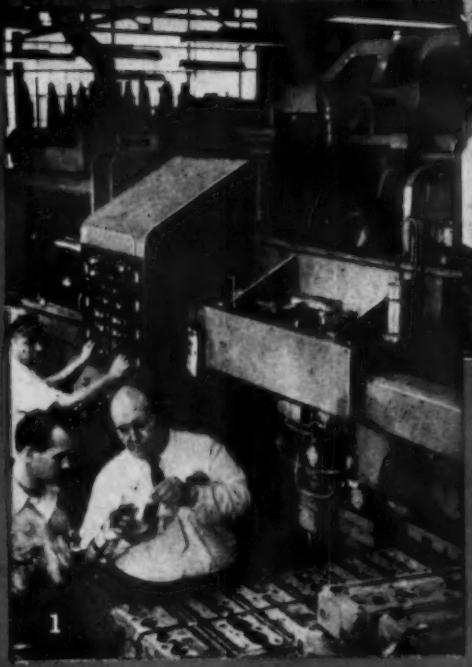
One of the original live-roller APC conveyor installations by Rapids-Standard is this beer warehousing operation. Cases can be seen moving at orderly intervals on the left and accumulating under power without pressure build-up. Hands are easily and safely inserted between cases for removal from line.

Rapistan®

The RAPIDS-STANDARD COMPANY, Inc.
793 RAPISTAN BUILDING
GRAND RAPIDS 2, MICHIGAN

HOW
MOBIL
HELPS

American Motors set



1

2

"The popular demand for Rambler Automobiles has resulted in sharply increased production requirements for our division. To keep our equipment running at capacity we have worked closely with Mobil Oil Company. This effort has been completely justified and has saved us considerable money."

MR. R. E. ANDERSON, *Superintendent, Motor Division, American Motors Corp.*

production records!

1. An annual change of hydraulic oil was once the rule for this large machine which broaches top and bottom of cylinder heads. Mobil engineers felt oil usage could be extended, performed periodic analyses that showed oil could be used three years. Examining oil sample is Anthony Belasich, Assistant Superintendent.

2. This "transfer line" machines cylinder heads. Subsequent washing operations were hampered by excessive "soaping" of the cleaner. Mobil traced the trouble to the cutting oil then in use... recommended an equally effective, but less costly product that solved the problem.

3. To meet production schedules, American Motors runs its engine division 24 hours a day at full capacity. Overload caused frequent breakdowns on the critical transfer machines that drill and ream 6-cylinder blocks. Mobil recommended a correct heavy-duty lubricant, suggested periodic filtering of lubricant and hydraulic oil. Stoppages were drastically reduced. Discussing filtering procedure are Rudy Naiberg, Assistant Superintendent and Frank Zuerner, Mobil Representative.

American Motors Plant at Kenosha, Wisconsin, fills increased production demands... reduces downtime... cuts labor and material costs!

Keep 'em coming! That's the order of the day for Rambler Automobiles, and production stoppages can be disastrous. When American Motors' far-sighted management anticipated production demands that would greatly exceed rated plant capacity, they promptly went about making preparations. Mobil was called in to insure correct lubrication for the highly critical production machinery in the motor division.

Mobil engineers, working in close cooperation with American Motors personnel, analyzed the lubrication problems posed by this record output . . . studied other problem areas as well. They recommended correct heavy-duty products, effective preventive maintenance procedures, techniques to reduce contamination and prolong lubricant life. As a result, machine downtime was greatly reduced, production availability sharply increased, and direct dollar savings to American Motors were achieved.

If you are interested in how Mobil may help you solve lubrication problems in your plant, call your nearest Mobil representative. Or write: Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

Mobil

CORRECT LUBRICATION

MOBIL OIL COMPANY, 150 East 42nd Street, New York 17, N. Y.

For more facts circle 509 on Reply Card

HELPFUL WATER CONDITIONING DATA FROM BETZ

PRETREATMENT FOR EFFECTIVE

■ Rapid film formation by pretreatment can vastly improve cooling water corrosion control. The benefits are many and the added costs are negligible.

THE ADVANCES MADE in the control of corrosion in open recirculating cooling water systems over the past decade have been phenomenal. The Dianodic methods[1] for corrosion control are capable of decreasing the corrosion rate of steel to 1 mil per year or less with the pitting function totally prevented or definitely stifled. Excellent protection is secured with treatment concentrations generally in the range of 30 to 100 ppm, depending on operating conditions and water characteristics. Because steel can be protected economically many of the newly designed plants include all-steel heat exchangers in place of the more costly and more commonly used Admiralty tubed heat exchangers. The cost of all-steel heat exchangers is approximately 60% of the cost of heat exchangers constructed with Admiralty tubes. Under these conditions the capital investment for a new plant is considerably less when steel is used.

However, the design engineer should be cognizant of all factors that have a bearing on the service life of steel tubed heat exchangers. The experiences of one plant designed with all-steel heat exchangers will illustrate several of the precautions that are necessary if the expected service life is to be secured. Shortly after this new plant went into operation, it was found that pressure drops across many of the heat exchangers were greater than anticipated. Examinations of the heat exchangers revealed that heavy tuberculation was present in the steel tubes and in the water boxes. Some of the tubes were blocked with tubercules that had broken free from other locations. It was evident that the handling of the bundles during construction of the plant permitted corrosion to start. The pressure of other work attendant with start-up did not allow sufficient time for initial cleaning of the heat exchangers for removal of debris, grease, and corrosion products that had accumulated during construction. No pretreatment of the heat exchangers was employed and the intermittent operation of the system permitted frequent periods of inadequate inhibitor concentrations so that corrosion progressed at a rapid rate.

A marked difference in the care of handling steel tubed heat exchangers compared to handling Admiralty tubed heat exchangers is evident from this and similar experiences. The corrosion rate of steel under these adverse conditions is many times greater than the corrosion of Admiralty and the quantity of corrosion products produced is proportionally greater. When steel tubed heat exchangers are employed, it is essential that care be exercised in the initial handling of the bundles to avoid corrosion during construction and initial start-up. It is mandatory to clean steel bundles and to pretreat them to render the metal surfaces passive.

Pretreatment

Most methods of corrosion control are based on forming a film that acts as a barrier to stifle corrosion. The rate at which the film or barrier forms will largely determine the effectiveness of the treatment. Materials that do not form films rapidly will permit corrosion to take place and the result will be incomplete film formation and continued corrosion. The rate at which the film forms is related to the inhibitor concentration.

The function of pretreatment is primarily to permit rapid film formation to stifle the corrosion reaction immediately by formation of a uniform impervious film. Under these conditions the low treatment levels will maintain the film intact and avoid the accumulation of corrosion products.

Reference to Figure 1, Curve A, shows the high initial corrosion rate of steel when exposed to Philadelphia tap water, fortified with 500 ppm of chloride, and at a temperature of 120 F. The application of 30 ppm of Zinc-Dianodic markedly decreases the rate of corrosion (to less than 1.5 mils per year at the end of 3 days). However, if the steel is first pretreated for rapid film formation with a treatment concentration of 500 ppm of Zinc-Dianodic for only 4 hours and thereafter treated with 30 ppm of Zinc-Dianodic an even greater reduction in the initial corrosion rate as well as the over-all corrosion rate results, as shown by Curve C.

The data contained in Figure 2, demonstrate the superior qualities of the film formed by 500 ppm of Zinc-Dianodic compared to 5000 ppm of chromate. Pretreatment with 5000 ppm of chromate for 2 hours permitted a 50% reduction in weight loss and a corresponding reduction in the amount of corrosion products that accumulate.

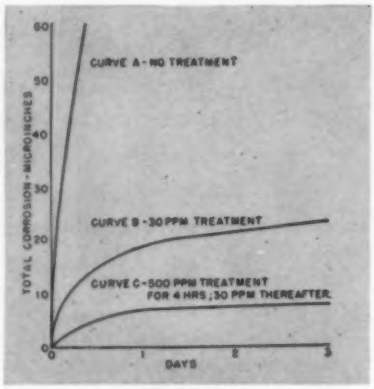


Figure 1

However, pretreatment with 500 ppm of Zinc-Dianodic for 2 hours permitted more than an 80% reduction in weight loss and a negligible accumulation of corrosion products.

The low treatment levels normally used for corrosion control in open recirculating systems should be viewed as the quantities required to maintain the film intact and to heal the slight breaks that may occur from minor variations in environment. Whenever any serious changes in environment occur that cause destruction of the film, corrosion products can accumulate before the film is re-established by the low treatment levels. Under these conditions, in order to secure maximum corrosion protection and to minimize accumulation of corrosion products, treatment levels should be increased to re-establish the protective film as rapidly as possible.

Pretreatment of steel heat exchangers is required . . .

. . . for all new bundles
. . . whenever the exchangers are acid cleaned
. . . whenever low pH is encountered
. . . whenever serious process leakage occurs
. . . immediately following start-up after inspections.

Care of Steel Exchangers

Initial Treatment

The care of new steel heat exchangers should start with the writing of the

(1) Dianodic is a registered trademark. The methods are covered by U. S. Patents 2,711,391; 2,900,222; 2,872,281; 2,848,299.

specifications. The design engineer should include as part of the specifications, a requirement that the units be delivered free of debris, grease and other foreign matter that may initiate corrosion, and that the units be protected from the weather during transit and prior to installation. As soon as possible after installation, and prior to placing the system in full operation, pretreatment should be applied to the circulating water to permit rapid film formation. A procedure of this type will avoid excessive pressure drops and assure maximum protection of the units as well as materially aid in achieving the anticipated service life of an all-steel system.

Other Factors

Once the film is properly formed, the normal treatment levels will serve to maintain the film and prevent corrosion under normal operating conditions. However, there are a number of factors that can destroy the film to such a degree that higher than normal treatment levels will be required to re-establish the film rapidly. For example, when an individual heat exchanger is acid cleaned, the film will be completely destroyed. Acid cleaning will leave the steel surfaces in a very active state and the initial corrosion rate will be very high. The normal treatment levels usually will not permit sufficiently rapid re-establishment of the film. Therefore, following acid cleaning and flushing, the unit should be pretreated.

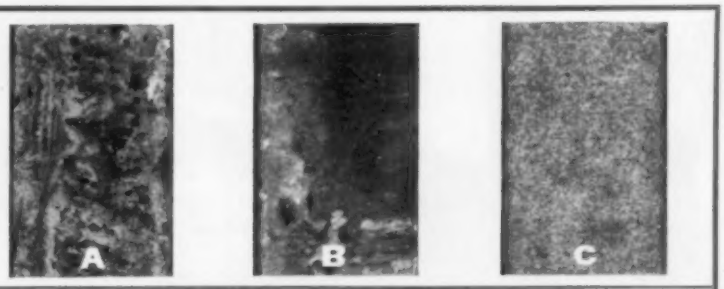
The modern day corrosion inhibitors function best in a pH range of 6.0-7.0. This same pH range permits maximum protection to tower wood and is usually the pH range required to avoid calcium deposits. Therefore, acid treatment of the circulating water to control pH is a common practice. In the great majority of these systems excellent control of pH is maintained. On occasion, however, low pH values may develop. If low pH is permitted for any extended period of time, partial or complete destruction of the protective film may occur. When this occurs, treatment levels should be increased to re-establish the film as soon as possible.

In other systems, process leakage may introduce hydrogen sulfide and mercaptans. This type contamination will have an adverse effect on most films. Also, leakage of this type usually produces a drop in pH as well. Until such time that the leakage can be corrected the system should be blown down heavily. If it is established that a particular heat exchanger is a chronic offender, it should be equipped with blowdown facilities so that as much of the blowdown as possible is taken from the offending heat exchanger. Following correction of the leak, treatment levels should be increased to rapidly re-establish the film.

The periodic inspections required for most systems will produce conditions during start-up that may increase the initial corrosion rate. For example, brushing or manual cleaning of the water boxes or other parts of the heat exchanger may partially or totally remove the protective film. Debris and migratory corrosion products may settle at various points in the system. These and many other factors will create conditions conducive to corrosion. Pretreatment by the use of higher than normal treatment levels during start-up will assure rapid repair of the protective film and minimize the accumulation of corrosion products.

The precautions outlined above will be instrumental in achieving maximum service life from all-steel heat exchanger systems.

CORROSION CONTROL



Specimen	Pretreatment (2 hrs.)	Loss-mgs. (24 hrs.)
A	None	36
B	5000 ppm chromate	18
C	500 ppm Zn-Dianodic	6

Conditions—Philadelphia tap water fortified with 500 ppm chloride. Temperature 120 F. 24 hour exposure in 8 ppm of Zinc-Dianodic after pretreatment as indicated.

Figure 2

General Application

While much attention has been focused on the use of pretreatment for all-steel systems because of the higher corrosion rates that can occur, the principles of pretreatment have application to and will prove beneficial for cooling water systems in general. It is true that the initial corrosion rates for Admiralty tubes or tubes of copper alloys in general are materially lower than for steel, and therefore the effects of these less voluminous corrosion products are not as pronounced. However, where Admiralty tubed heat exchangers are employed the systems are bimetallic since the shells and water boxes are constructed of steel. While the Admiralty heat exchanger tubes are not adversely affected, the steel components of these units do undergo an initially high corrosion rate and produce voluminous corrosion products that interfere with proper and complete film formation. The application of the principles of pretreatment for rapid film formation, followed by the use of normal treatment levels for film maintenance will prove of benefit in minimizing corrosion of the steel parts of the system. In general, improved heat transfer, longer service life and less plant maintenance are the benefits that will be secured.

The Dianodic methods developed by Betz are the most effective corrosion control treatments for recirculating cooling water systems. Their effectiveness is due to the ability to form protective films rapidly and to maintain these films with relatively low treatment levels. The Betz Engineer in your area will be pleased to discuss corrosion control and the application of pretreatment to handle your cooling water problems. Why not contact him *today?*

BETZ LABORATORIES, INC.
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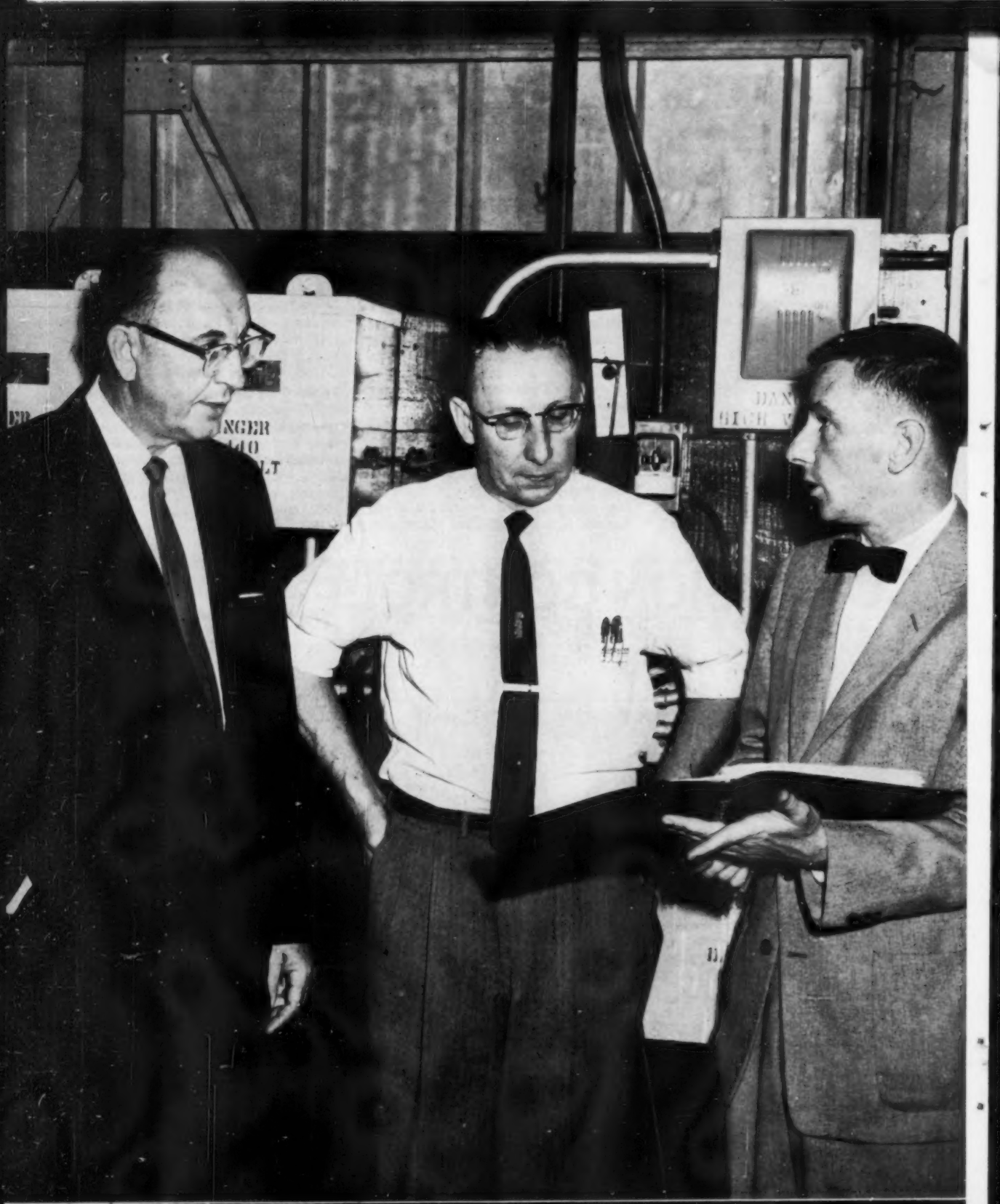
BETZ

CONSULTANTS ON INDUSTRIAL WATER PROBLEMS



Roy Lindeman, Purchasing Agent, and Al Krannich, Assistant Chief Engineer, of the Burt Manufacturing Company, Akron, Ohio, discuss Westinghouse products as applied to Burt fan-ventilator equipment with R. R. Burke, Salesman for Moock Electric Supply Co., Akron.

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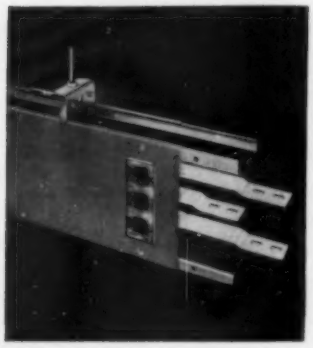

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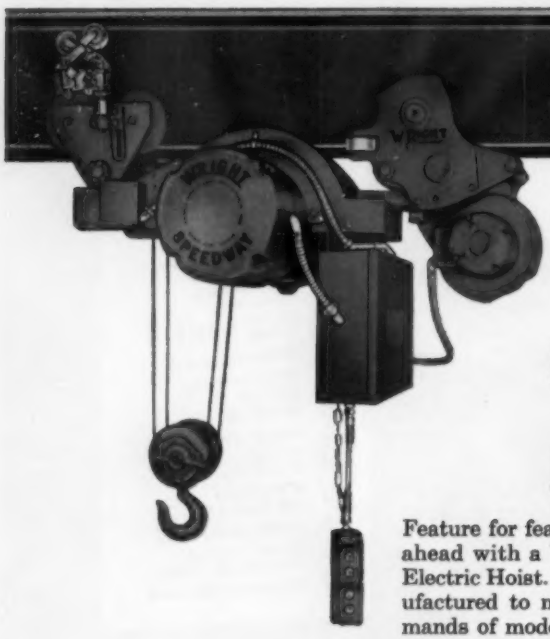

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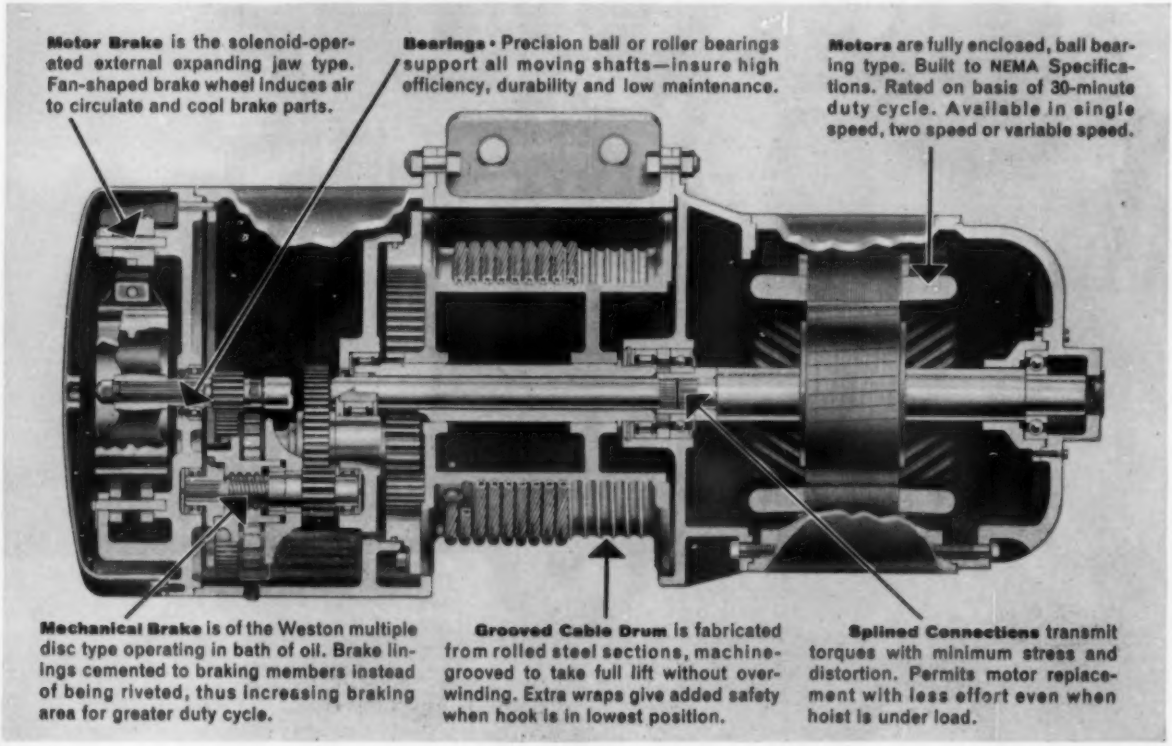
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BULLETINS just released and of immediate plant interest

MATERIALS HANDLING

Coordinated Handling—New techniques and applications of materials handling equipment and systems in warehousing, manufacturing and other areas are described in 46-pp Catalog GC-1. Covers principles of a coordinated materials handling system, gravity conveyors, powered conveyors, framing material and live storage racks, overhead conveyors, industrial conveyors, conveyor system accessories, casters and wheels. The Rapids-Standard Co., Inc.

▲ For a copy, circle 101 on Post Card

Winches and Hoists—Contained in this catalog file is information on lightweight winches and hoists. Pertinent data and drawings are provided for rescue hoists, heavy duty cargo hoists, boom drives, hand operated hoists, combination winches and hoists and various hooks and accessories, including a remote cargo hook. Breeze Corps., Inc.

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Stevedoring Truck—Bulletin SS-1836 gives specifications of the Utilitruc 8024, 8000-lb capacity gas-powered fork truck for stevedoring applications. Contains capacity chart, upright dimension table and drawbar pull chart. Drawings show turning radius in all dimensions, Industrial Truck Div., Clark Equipment Co.

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Live Storage—Photographs, drawings and diagrams explain principles, operation and installations of Rapistan flow rack for live storage in this 8-pp bulletin. Advantages are discussed and illustrated by diagrams and photographs of eight installations. Snap-on fittings providing flexibility in construction and adaptation are discussed and illustrated with five basic types of trackage offered. The Rapids-Standard Co., Inc.

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Bin Boxes—A 12-pp guide to lower handling costs, this booklet covers economics, design considerations, material requirements, types and features of unit load containers. Discusses factors to be considered in design of high-capacity containers, in determining effectiveness of bin boxes in a particular application. Material presented is based on information from many sources. National Wooden Box Ass'n.

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Deep Trough Idlers—Eight-pp Book 2716A contains selection data on 35- and 45-deg deep trough idlers designed for handling such heavy materials as coal, sand, gravel, crushed stone and crushed ores. Contains capacity ratings and design information. Link-Belt Co.

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Elevator Rope—Advantages of company's elevator cables are detailed in 12-pp Catalog E-10-2, which also gives practical selection information, safety factors and tips on lubrication, inspection and maintenance. Specifically, this booklet tells how to determine lubrication of elevator rope, when to retire it, how to guard against unusual tension and how to socket elevator rope. Compares six and eight-strand ropes. Lists ropes suited for 12 common types of installations. Macwhyte Wire Rope Co.

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Car Retarder—Featured in this product bulletin is a mechanical car retarder designed to bring rolling freight cars to a stop and resist further movement from impact of succeeding cars. American Brake Shoe Co.

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Vibrating Feeders—Illustrated and described in 6-pp Folder 2770 are vibrating feeders which incorporate a new principle of vibration for high-capacity, controlled feeding of heavy and highly abrasive bulk materials. Table of dimensions and capacities included. Link-Belt Co.

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CONSTRUCTION

Modular Buildings—Advantages of the modular building concept for fast and economical construction are detailed in this 8-pp bulletin. Illustrated with photos of typical applications, it describes basic system of steel framing with wall panels applied by means of spline system. Modular Buildings, Inc.

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Metal Roof, Floor Deck—Detailed information on company's metal roof and floor deck is presented in this 8-pp bulletin. Physical properties and detailed specifications are included. Bowman Steel Corp.

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For Longer Lasting Floors—Ability of Masterplate "iron-clad" concrete floors to last six times longer than many concrete floors is detailed in 24-pp Bulletin MP-4d. Features important to industrial floors are covered: wear and corrosion resistance, economy, spark resistance, static dissemination, non-slip, non-dusting, easily-cleaned surfaces. Installations of Masterplate floors are illustrated. The Master Builders Co.

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Furred Ceilings—Technical Bulletin 16 tells the how's and why's of furred metal lath ceilings. The assembly is made by attaching metal lath to steel channels, pencil rods, or furring strips in direct contact with overhead construction. Specifications and installation details are included. Metal Lath Manufacturers Ass'n.

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Monolithic Sheeting—Colorlith, a monolithic asbestos-cement sheeting resistant to physical and chemical abuse, is described in 12-pp Brochure IN-296A. Gives available thicknesses and recommended optimum thicknesses for certain applications, also recommended procedures for fabricating, bonding and cementing, and suggestions for maintenance of applied surfacing. Physical properties are tabulated, as is chemical resistance. Johns-Manville Corp.

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Structural Damping—Rigidamp fabrications combining viscoelastic damping materials to produce rigid, highly damped surfaces, are discussed in 6-pp Bulletin 60-10. Explains what Rigidamp does, how it works, where it is needed and advantages afforded by its use. Barry Controls Inc.

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INSULATION

Glass Fiber Insulation—Advantages to be gained from insulating storage tanks with glass fiber insulation are detailed in this 8-pp bulletin. Thermal conductivity curve included and application methods are described. Gustin-Bacon Mfg. Co.

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Pipe Insulation—Kaylo-Klad, a high temperature insulation for industrial piping in the power, chemical and refining industries, is described and illustrated in this bulletin. Advantages covered include: "locking out" weather, fabrication with simple tools, and fast installation. Owens-Corning Fiberglas Corp.

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Postage-free Reader Service Cards make it easy to order bulletins. Cards are provided on pages 317 and 318.

Dual-Density Liner—Micro-Bar, a fiber glass duct liner, is described in 8-pp Brochure IN-302A. Stresses advantages of this dual-density liner in checking air erosion, cutting noise, and improving insulating efficiency etc. Also describes the material itself. Illustrates various application techniques, before and after forming the sheet metal, including joints that eliminate use of coatings, sealers or metal nosings. Johns-Manville Corp.

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PUMPS, COMPRESSORS

Volatile Liquid Pumps—Six-pp Bulletin 101 includes cross-section drawings of the standard short coupled vertical turbine model of company's volatile liquid pumps. Applications are illustrated. Also explained and illustrated are design details contributing to pumps' efficiency. Layne & Bowler, Inc.

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Pneumatic Pump—Bulletin 4601 describes a pneumatic pump for problem materials, such as oils, molasses, brine, paints, acids, and molten salts, slurries and alkalis. Includes selection data, installation diagrams. Yeomans Brothers Co.

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BULLETINS

(Begins on page 21)

For Inflammable Liquids—"Canned" pumps for handling inflammable liquids in hazardous locations are covered in Bulletin 728.1. Gives detailed specifications, materials of construction, performance curves and dimensions for the seal-less centrifugal pumps available in two sizes, capacities to 100 gpm, heads to 100 ft. Goulds Pumps, Inc.

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For Submerged Pumping—Described in 6-pp Bulletin F-1976 is a line of motors for low head submerged pumping. Design features are detailed with full cross-section drawing, and operating advantages, dimensional data and ratings covered. U. S. Electrical Motors Inc.

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Single-Stage Compressor—Eighteen-pp Bulletin P-13 features a performance calculation method which permits selection of proper compressor for most applications. Selection plan includes various curves, plot data on three types of impellers to assure right frame selection, as well as component selector. Elliott Co.

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LUBRICATION

Automatic Valve Lubricator—Illustrated and described in 8-pp Bulletin V617 is automatic lubricator for plug valves. Construction details, installation and operation are described. The Rockwell Mfg. Co.

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On Solid Lubricants—Theory and practice of lubrication by solids are primary subjects of 24-pp Bulletin 124. Discusses major advantages of molybdenum disulfide solid lubricants—low coefficient of friction, natural affinity for adherence to metal surfaces, pressure resistance beyond yield point of metals. Booklet explains how molecular structure accounts for its function as a lubricant. The Alpha-Molykote Corp.

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MECHANICAL POWER TRANSMISSION

Shaft-Mounted Reducers—Technical information on shaft-mounted geared speed reducers as well as illustrations, descriptions and selection data are presented in 12-pp Form F-2003. Tables are included showing service classifications to be applied in determining types of speed reducers for industrial and other applications. U. S. Electrical Motors Inc.

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Gears, Speed Reducers—This 246-pp gear and speed reducer catalog contains complete information on sizes, ratings and specifications of company's gears and speed reducers, including pressure angle spur gears, bevel gears, mitre gears, worm gears, spiral bevel gears, racks and sprockets. Detailed engineering data on proper selection of gears and reducers to meet specific job requirements are included. Available to qualified plant engineers, please state your job title. The Ohio Gear Co.

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Narrow Sheave Drives—Advantages of company's narrow sheave drives are detailed in 24-pp Catalog SW-1. Includes selection and installation data, drive selection tables, horsepower ratings, sheave dimension tables. Maurey Mfg. Corp.

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Timing Belt Drives—Described in 8-pp Bulletin 21103 is a method of selecting timing belt drives involving a minimum of mathematics. Includes five sets of curves for drive-width selection, designed to eliminate computation. T. B. Wood's Sons Co.

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Variable Speed Drives—Details on multiple groove variable pitch sheaves are presented in 24-pp Catalog MVP-101. Detailed specification data, dimensions and diagrams are included. Browning Mfg. Co.

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Variable Speed Drives—Principle of operation and other information on company's variable speed drive which uses the compound planetary gear system is presented in 12-pp Bulletin 550. Explains how variable speeds are obtained, gives operating advantages and selection data. Graham Transmissions Inc.

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PIPING, FITTINGS

Vitrified Clay Pipe—This 6-pp brochure on clay pipe, describes basic clay products, typical characteristics and uses of vitrified clay pipe, and the latest joints designed to give better control over infiltration, exfiltration and root penetration. National Clay Pipe Manufacturers, Inc.

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Pipe Connections, Accessories—This 44-pp 1960 catalog presents pipe connections and accessories designed on the new Grayloc seal principle. It covers all new types and ratings of Grayloc clamps, collar type unions, flanges, closures and bleeder valves. Products with related applications are also catalogued, including bi-metallic pipe, fittings. A feature is a 10-pp table of allowable working pressures for pipe and connections from 1 to 30 in. to 1500 F. Relative costs of 39 piping materials are also tabulated. Gray Tool Co.

▲ For a copy circle 135 on Post Card

Hose Fittings—Low pressure, reusable hose fittings and rayon braid hose are featured in this 12-pp product bulletin. Contains data on reusable hose couplings, union swivel adapters, hose assemblies in one and two rayon braid with reusable couplings, oxygen and acetylene couplings and connectors, paint spray air hose couplings and connections, hose stems, joiners, adapters. The Lenz Co.

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On pages 317-318 are two postage-free Reader Service Cards provided for your convenience in ordering these bulletins. You may also use the cards to order any literature mentioned in ads.

Transite Drainage System—Benefits and economies of Transite pipe for storm water drinage and storm sewer systems are described in 10-pp Bulletin TR-252A. Cost comparison data, selection data and specifications are included, as well as photos of typical installations. Johns Manville Corp.

▲ For a copy, circle 134 on Post Card

ELECTRICAL

Motor Selection Guide—This pocket-size card (GED-3909A) provides quick reference to frame size (182 to 445U) and book price for a-c motors from ¾ to 125 hp. Data are tabulated for both dripproof and totally enclosed fan-cooled Tri-Clad '55 squirrel cage, horizontal motors. General Electric Co.

▲ For a copy, circle 137 on Post Card

Synchronous Motors—Four new types of Slo-Syn motors are presented in this 6-pp bulletin, including types for general and heavy-duty application, an explosion-proof model and one designed to meet applicable military specifications regarding materials vibration. Instant starting, stopping and reversing, adaptability as a stepping motor, and other advantages are discussed; dimensions given. The Superior Electric Co.

▲ For a copy, circle 138 on Post Card

Pump Motors—This 34-pp brochure consists of a collection of technical articles on pump motors, illustrated with charts, diagrams, graphs, tables, and cutaways. Subjects range from turbine pump motor lubricants, pump motor bearings, to pumping stations and sound control, and steps in submersible installations. U. S. Electrical Motors Inc.

▲ For a copy, circle 139 on Post Card

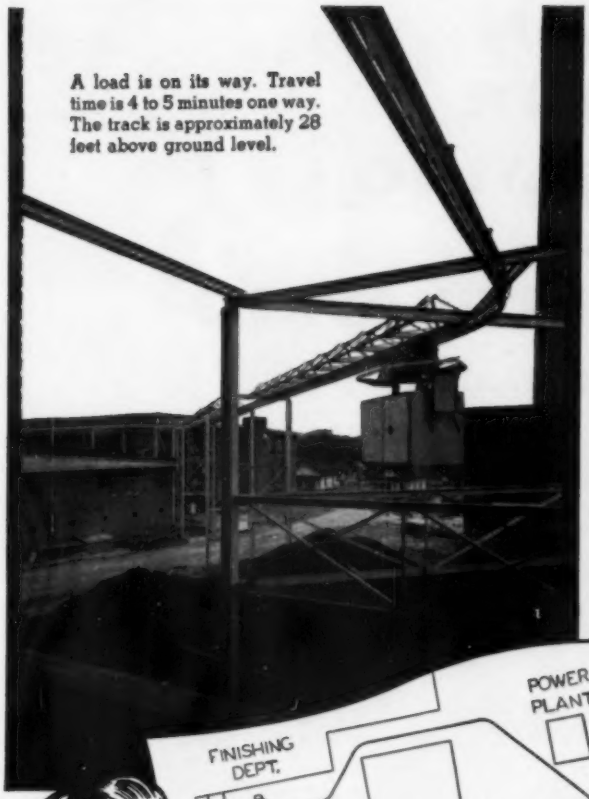
High-Frequency Bus Duct—Detailed information on high-frequency bus duct is contained in 12-pp Application Data 30-663. Descriptions, drawings, dimensions, specifications and engineering and test data included. Westinghouse Electric Corp.

▲ For a copy, circle 140 on Post Card

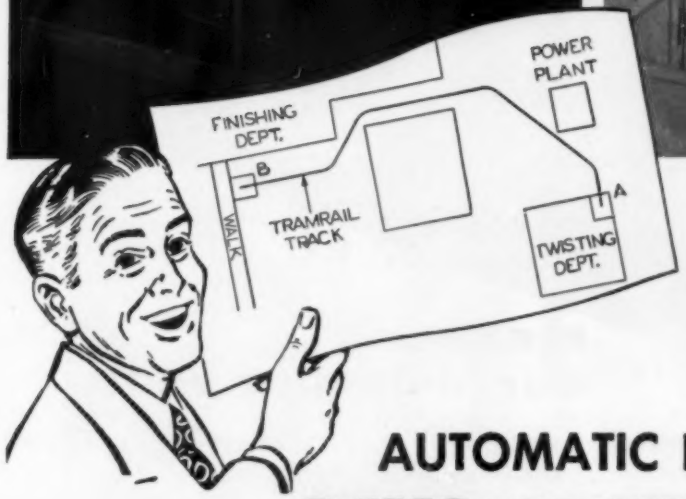
Truck Battery Selection—Presented in this 8-pp battery selection chart for electric industrial trucks are dimensions, amp-hr capacities, weights, other data for 16 battery types. These cover ratings from 12 to 36 v and amp-hr per positive plate from 40 to 95. Dimensions for batteries in combination of six to 18 cells are tabulated. Also presented are recommended layout specifications, and selection data on terminal connectors. Gould-National Batteries, Inc.

▲ For a copy, circle 141 on Post Card

(More Bulletins on page 319)



A load is on its way. Travel time is 4 to 5 minutes one way. The track is approximately 28 feet above ground level.



Four trucks are accommodated by the Tramrail freight van, which, at the press of a button, is on its way without attendant. The van stops and lowers automatically at each end of the system. In fair weather or foul it travels with safety and dispatch. Points on each end of Tramrail carrier guard pry open doors of loading station automatically. The system requires very little building space because it need not be enclosed.

AUTOMATIC DISPATCH SYSTEM **PAYS** FOR ITSELF EVERY TWO YEARS

AN enclosed freight carrier shuttling over a 666 foot Cleveland Tramrail archbeam track between the Twisting and Finishing Departments of the China Grove Cotton Mills Co., China Grove, N. C., is making a tremendous saving every year.

This system has eliminated a drudgery that was disliked by labor and costly to management. No longer is it necessary for men to push and lug floor trucks up ramps, on elevators and over long walks between the buildings. No longer is the work held up because of rain or inclement weather. Frequent accidents from manual hauling are done away with.

For the investment involved, this automatic system is paying large dividends in profits and convenience for this mill which is one of the largest producers of thread yarn in the South.

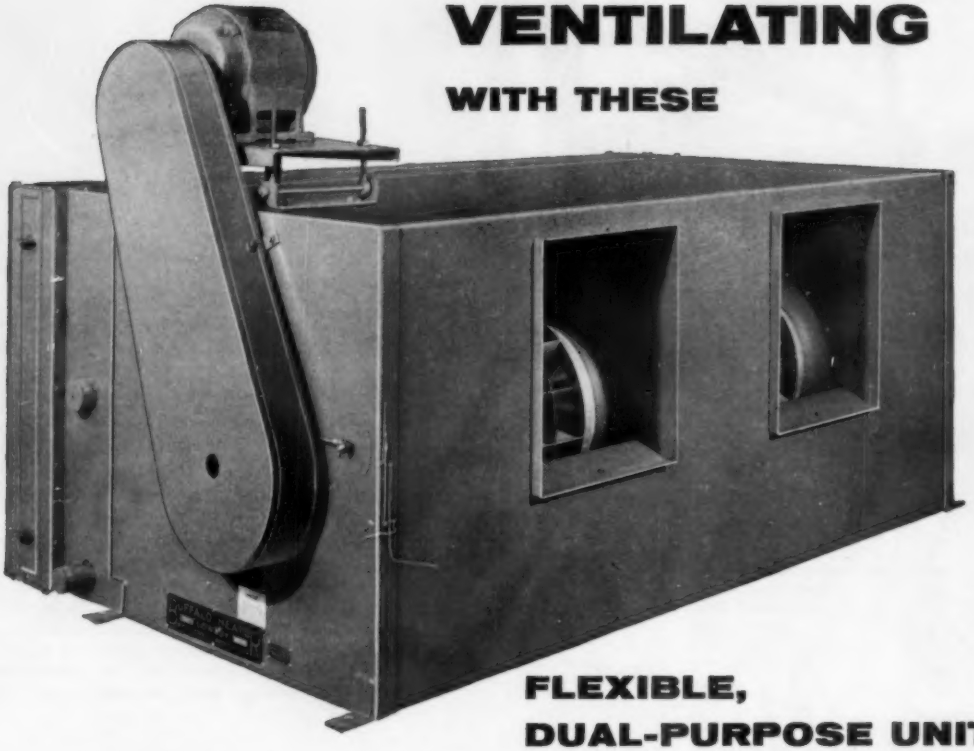
Write for free Engineering and Application Booklet No. 2008. Packed with valuable information.

CLEVELAND TRAMRAIL

Overhead Materials Handling Equipment

CLEVELAND TRAMRAIL DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 7573 E. 287 ST. • WICKLIFFE, OHIO

PLAN YOUR HEATING AND VENTILATING WITH THESE



FLEXIBLE, DUAL-PURPOSE UNITS

BUFFALO Model G HEATING and VENTILATING UNITS are available for heating and ventilating or ventilating only. In cold climates, they deliver the heat you need, where you need it — plus ventilation. In hot areas, they circulate cooling, refreshing air.

And *Buffalo* Units offer you these *extra* advantages:

Sectionalized Cabinet — easy to assemble, easy to install and easy to service — includes fan section, coil and base section of welded heavy gauge construction. Available with ½" spray-coated fiberglass insulation inside.

High-Performance Fans — streamlined housings, oversize hollow shafts and mixed flow wheels for stability and efficient distribution at low velocities.

Efficient heating coils — Aerofin Type BNF non-freeze for steam heating to 200 psig and 400°F.; Type H for hot water heating.

Choose any combination — Type HV for horizontal or vertical operation, both heating and ventilating; Type V for ventilating only; choice of filter boxes, mixing boxes, dampers; 45° or 90° outlet elbows, swivel or stationary.

Write for Bulletin UH-130 and select the models that will handle both your heating and ventilation needs at once!

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

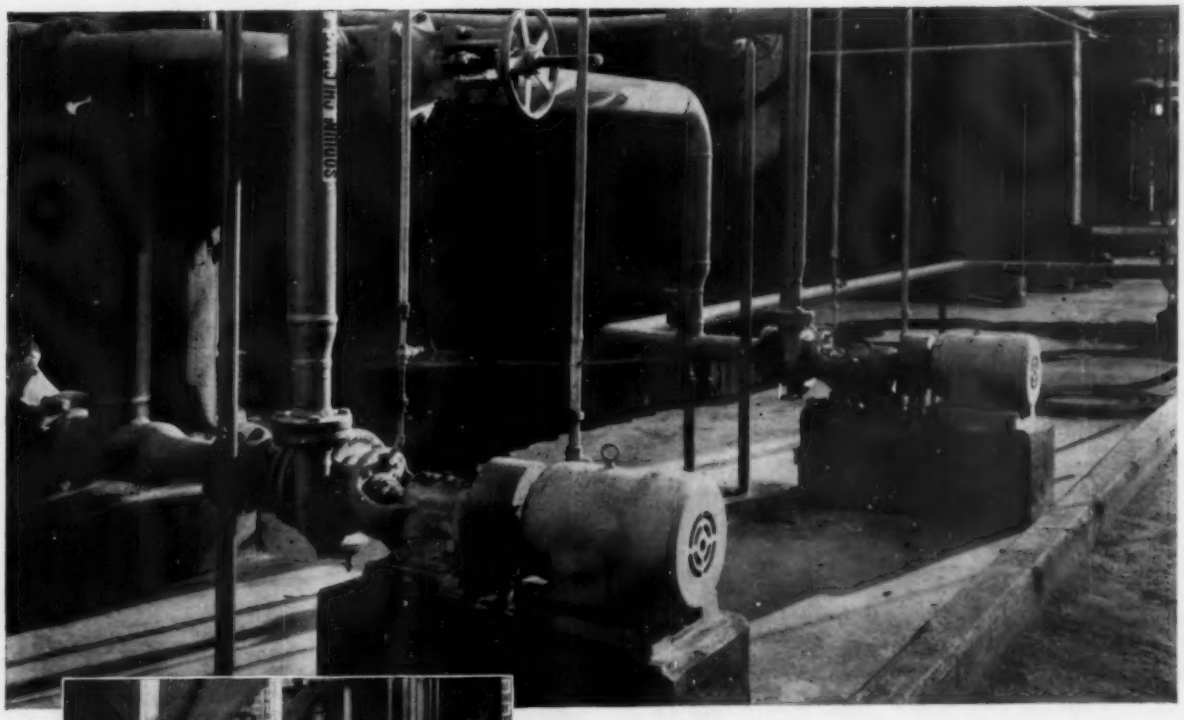
Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

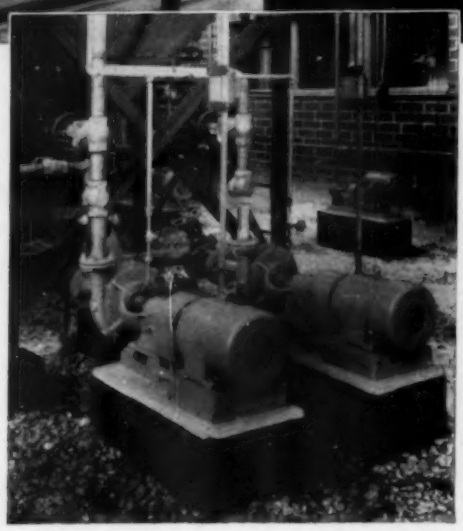
Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

For more facts circle 515 on Reply Card





Above — "Buffalo" Single Suction Full Ball Bearing Pumps, stainless steel construction, handling sodium chlorate.

CORROSION— CONTAMINATION CONTROLLED WITH "BUFFALO" PUMPS

At left — "Buffalo" Single Suction Pumps of stainless steel construction handling hydrogen peroxide bleach.

Using a wide range of materials of construction, "Buffalo" offers a line of pumps capable of handling your toughest liquid moving job. You can order a "Buffalo" pump made of Hastelloy B or C, nickel, bronze, lead, stainless, in fact just about any material that can be cast and machined.

Properly applied, these pumps can cut your liquid moving costs, reduce down-time due to pump failure and improve quality control where contamination may be a factor.

For your tough liquid moving jobs, phone or write your "Buffalo" Engineering Representative or write direct. Tell us the liquid you want to pump and we will be pleased to suggest the best material of construction for the job.

"Buffalo" PUMPS

BUFFALO PUMPS
DIVISION OF BUFFALO FORGE CO.
BUFFALO, NEW YORK
CANADA PUMPS LTD., KITCHENER, ONT.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

For more facts circle 516 on Reply Card

"BEST WAY TO BEAT CORROSION PROBLEMS? QUALITY PAINTS PLUS TECHNICAL KNOW-HOW!"

Sound advice from a man who knows. Dick Durham, a member of Du Pont's new Technical Service Group, has been solving paint maintenance problems for most of his 27 years in the business.

"No one can afford the high cost of corrosion," says Dick. "That's one reason Du Pont Paints are so often specified. Take, for example, our popular Tank White Enamel. Its lasting whiteness and high reflectivity have meant substantial savings in the petroleum industry by reducing evaporation losses. Its durability is outstanding, too. On one tank in a large refinery, this tough finish lasted more than *20 years* . . . despite exposure to HF and SO_2 fumes, water spray and weathering.

"But quality paints are only part of the story when you specify Du Pont. Just as important, from the standpoint of long-term savings, is technical assistance in applying them. You see, we base our recommendations on a first-hand analysis of your particular maintenance needs. Result: protection that's tailored to the conditions in your plant—*at lowest cost per square foot per year.*"

You'll find a man like Dick Durham working out of the Du Pont district sales office nearest you. Why not take advantage of his training and experience? For complete information on how to beat your *own* corrosion problems, give him a call. Or write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. PE-610, Wilmington 98, Delaware.

* * *

With the Du Pont Finishes Division since 1933, Richard D. Durham is headquartered in his native Birmingham, Alabama. A corrosion specialist, he has helped find the answer to maintenance problems for the paper, textile, chemical, petroleum and steel industries throughout his territory. At home, he's a member of the Birmingham Paint Club and the Birmingham Sales Executives Club.

DU PONT PAINTS

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

For more facts circle 517 on Reply Card

For more facts circle 518 on Reply Card →

recipe for profit
the Westinghouse recipe for motor controls gives you reserve capacity reliable operation matched to the job performance!
YOU CAN BE SURE IF IT'S Westinghouse

TESTED RECIPES FOR PROFIT . . .

the blending of ingredients in Westinghouse controls meets today's demands for profitable production

Combine advanced design ability and modern manufacturing facilities . . . fold in select materials and quality components. Mix in years of research and experience. Spice as required with superior application and engineering assistance. Baste with outstanding quality control until mixture attains perfection. Garnish with nationwide repair facilities.

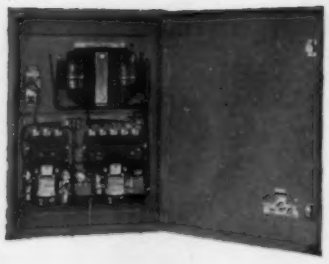
That's the Westinghouse control recipe. But just as a chef's deft touch is the final element needed to turn fine ingredients into an epicurean triumph, so a generous portion of Westinghouse experience and know-how blends superior control ingredients. Result: **more control value for your money** — reserve capacity to handle overloads . . . long, trouble-free service . . . and apparatus performance matched perfectly to your needs. Hidden qualities that distinguish Westinghouse controls . . . and your best insurance against costly down time.

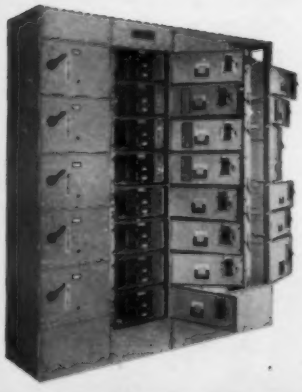
Westinghouse makes a wide range of outstanding industrial motor controls. Ask your local Westinghouse representative to explain all their hidden values . . . benefits by the baker's dozen . . . for more profitable plant operations. He'll be glad to assist you in applying Westinghouse controls.

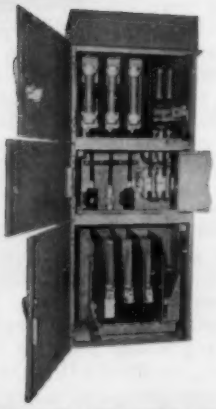
Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

YOU CAN BE SURE...IF IT'S Westinghouse

Just ask any gourmet. Good ingredients alone don't guarantee an epicure's delight. It takes years of experience to convert a basic recipe into a blue ribbon winner. So, too, with superior electrical products.







Ampgard® High-Voltage Starters

Maximum protection for motors, systems and personnel.

Faults interrupted in less than ½ cycle . . . isolates fault to prevent shutdown of other equipment.

Completely front accessible.

Externally operated line isolating switch.

Exclusive mechanical and electrical interlock . . . prevents switch operation under load; automatically stops motor when cabinet is open.

Full line available . . . for squirrel-cage, wound-rotor and synchronous motors up to 3000 hp — up to 5000 volts.

® Trade-Mark

Reduced Voltage Starters

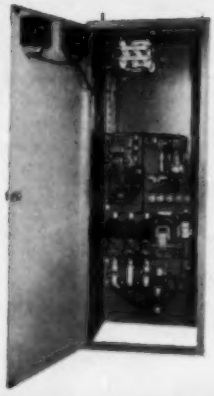
Widest possible selection of primary resistor, auto-transformer, part-winding and star-delta types for squirrel-cage, wound-rotor and synchronous motors in all hp ratings — up to 600 volts.

Manual and magnetic starters to provide the proper starting characteristics for any application.

Available with integral circuit breaker or disconnect switch — fused or non-fused.

Enclosures available for every need . . . general purpose . . . dust-tight industrial . . . watertight . . . explosive atmospheres.

Available for immediate delivery.



Static Slipsyn® Synchronous Motor Control

Static transistor circuit guarantees . . . maximum reliability and accuracy; no moving parts to wear, corrode or fail; unaffected by contaminated atmosphere.

Motor field excitation applied at precise speed and pole position.

Adjustable pull-out protection, permits immediate detection or delays action to eliminate false tripping caused by transients.

Available as complete starter or field conversion unit for **any make** control!

Control Centers

Compact grouping of all motor controls

cuts installation time;

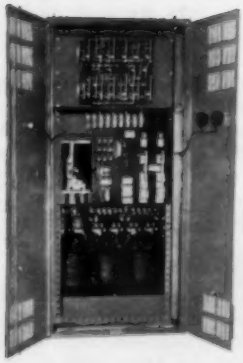
frees production areas;

permits easy one-man control supervision;

speeds maintenance and service.

Interchangeable modular construction.

DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY



D-C Packaged Power Supplies

Ideal for cranes, elevators, magnetic chucks, etc.

"Packaged" units, including control, are ideal for "on-the-spot" conversion of a-c to d-c, eliminating long line voltage drops.

Lower first cost, lower installation cost than motor-generator set.

Require approximately 67% less floor space, weigh less than half of equivalent motor-generator set.

Completely static units — essentially maintenance-free.

Hermetically sealed silicon cells prevent contamination of the rectifier; no apparent aging assures years of trouble-free service.

"THIS LUBRICANT STOPPED THE 'FLAKING' OF ROLLING MILL GEARS"

says—VANADIUM-ALLOYS STEEL CO.

"The herring-bone gears in the drive unit of our 6-stand, 10-inch mill that rolls our high speed tool steels became noisy. Inspection showed definite signs of flaking of gears. This was in 1939. It was then we started to use LUBRIPLATE in them and we have not encountered any flaking trouble since."

L. M. Potter
Purchasing Agent

REGARDLESS OF THE SIZE AND TYPE OF YOUR MACHINERY, LUBRIPLATE GREASE AND FLUID TYPE LUBRICANTS WILL IMPROVE ITS OPERATION AND REDUCE MAINTENANCE COSTS.

LUBRIPLATE is available in grease and fluid densities for every purpose . . . LUBRIPLATE H. D. S. MOTOR OIL meets today's exacting requirements for gasoline and diesel engines.

For nearest LUBRIPLATE distributor see Classified Telephone Directory. Send for free "LUBRIPLATE DATA BOOK" . . . a valuable treatise on lubrication. Write LUBRIPLATE DIVISION, Fiske Brothers Refining Co., Newark 5, N. J. or Toledo 5, Ohio.

For more facts circle 519 on Reply Card

BACKTALK AND FORETHOUGHTS

Edited by Marjorie E. Weissman

Makeup Water Concentrations

PLANT ENGINEERING:

"Would you please forward a complimentary copy of 'Concentration Formulas Derivations' pertaining to makeup water, as appears in your April, 1960 issue of PLANT ENGINEERING magazine." *J. L. Cooke, Plant Engineer, International Business Machines Corp., Peekskill Laboratory, Yorktown Heights, N. Y.*

PLANT ENGINEERING:

"I would like to have a complimentary copy of 'Derivations of Formulas' pertaining to makeup water in air conditioning water towers.

"The article on 'Water Treatment and Cooling Tower Troubles' in the April issue of PLANT ENGINEERING was very interesting and helpful." *Joe T. Hardee, Building Manager, The Citizens National Bank of Lubbock, Lubbock, Tex.*

▶ Complimentary copies of the derivations of formulas for determining the number of cycles of concentration that makeup water will undergo when there is no bleedoff, and for determining the bleedoff required to limit the number of cycles of concentration of makeup water to below the theoretical number of cycles, are still available to readers.—*Editors.*

Articles on Hydraulic Systems

PLANT ENGINEERING:

"Thank you for the articles on pneumatic-hydraulic actuation systems. I think they are well-written and clear.

"Please send me a list of previous articles available, particularly related to hydraulic systems." *Milton J. Brodie, Engineering Department, Rucker Co., Oakland, Calif.*

▶ Glad to help out with tear sheets of articles we have published on this subject. For those interested in the selection, installation and maintenance of the various components of pneumatic-hydraulic systems, the booklet, "Fluid Power Maintenance" is available at 75 cents a copy.—*Editors.*

Modular Packaging For Parts

PLANT ENGINEERING:

"I have a policy of not writing thank you or congratulatory letters to editors or writers. The reason for this is that as an ex-advertising man I still have a great deal of awe of the editorial side of the book and, perhaps naively, feel that news gets into print because it is news. However, I do want to break my policy in this instance. I thought your article 'Modular Knockdowns Cut Repair Parts Damage' in the July, 1960 issue of PLANT ENGINEERING, was excellent.

"It might be interesting to you to know that the Rocketdyne standard packaging system is the most practical application of the 'Modular Panel System' that I have yet seen. Until Rocketdyne's industrial engineering group figured out standard procedures for using modular panel packing methods, everyone was agreeing on what a great idea modular panel packaging was, but there was no agreement on its use.

"As far as I can see, most packaging engineers are too used to specifying containers for individual items; find it difficult to span the broad concept of a system of packaging for many items." *Norman S. Maxwell, Sales Promotion Manager, Navan Products, Inc., El Segundo, Calif.*

Cleaning With Sulfamic Acid

PLANT ENGINEERING:

"The article entitled 'In-Place Acid Cleaning' in the May, 1960, number of PLANT ENGINEERING is one of the most interesting I have found in an engineering magazine for some time. It is a safe bet that this opinion will be shared by a great many plant engineers and that you have probably been deluged with requests for samples and more information." *A. J. Lubeley, Resident Engineer, Anheuser-Busch, Inc., Los Angeles, Calif.*

He's Right About Our Readers

PLANT ENGINEERING:

"It has occurred to us that we have been delinquent in not writing to thank you for your editorial comment on our product, Dex-O-Tex. It was described in the article "This Concrete Ignores Sugars, Syrups," in the April issue of PLANT ENGINEERING.

"A number of inquiries have resulted in gratifying response and, although it is still rather early to judge what percentage will be converted into sales, I would estimate offhand that at least 15 per cent of your inquiries have been from 'hot' pros-

Now RIDGID® Sets The Pace In Tubing Tools, Too!

Long the outstanding quality leader in pipe tools, RIDGID now leads the way in tubing tools. Compare these new RIDGID Tubing Tools with the ones you're now using . . .

Compare them for advanced design . . . quality construction . . . economy. You'll find RIDGID Tubing Tools last longer . . . give the most all 'round value for the money.

Choice of 8 RIDGID® Tubing Cutters

For Copper, Brass, Aluminum, Tubing and Thin-Wall Conduit!

RIDGID No. 105 Tubing Cutter
Open or Closed
Only 5" Long
Full ⅛" to 1⅛" O.D. Capacity

RIDGID Nos. 10, 15 and 20 Tubing Cutters
Lightweight Aluminum Alloy Frames . . . Fold-in Reamers
No. 10—⅛" to 1" O.D.
No. 15—⅜" to 1⅛" O.D.
No. 20—½" to 2⅛" O.D.

RIDGID No. 205 Tubing Cutter
Fast Slide-to-Size . . .
Instant Trigger Release.
⅛" to 2⅜" O.D. Capacity

RIDGID Nos. 30 and 40 Tubing Cutters
Perfect Tracking . . . No Burrs . . . Aluminum Frame.
No. 30—1" to 3" O.D.
No. 40—2" to 4" O.D.

RIDGID No. 315 3-Wheel Tubing Cutter
For Emergency Use Where Full Turn Is Not Possible.
No. 315—⅜" to 1⅛" O.D.

Choice of 3 RIDGID® Flaring Tools!

All parts are locked together . . . Automatic feed release . . . Rolling cone action produces smooth, uniform flare walls. 3 models for 45° and 37° S.A.E. flares.

RIDGID No. 457 for 45° flares, ⅛" to ¾" O.D. (7 sizes)

RIDGID No. 459 for 45° flares, ⅛" to ¾" O.D. (9 sizes)

RIDGID No. 376 for 37° flares, 3/16" to ½" O.D. (6 sizes)

SEE, TRY AND BUY THESE RIDGID WORK-SAVER TUBING TOOLS AT YOUR SUPPLY HOUSE!

RIDGID

The Ridge Tool Company, Elyria, Ohio, U.S.A.

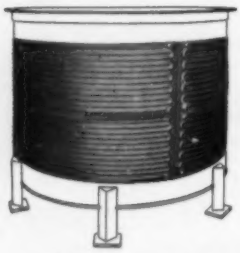
For more facts circle 520 on Reply Card

HEAT YOUR TANK THE MODERN LOW COST WAY

with superior

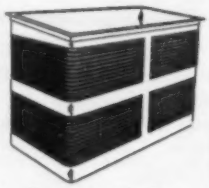
DEAN® PANELCOIL

Regardless of your operation or the size or shape of your tank, if it is to be heated or cooled, Dean Panelcoil can do the job more economically and more efficiently than old-style pipe coil or jacketing.



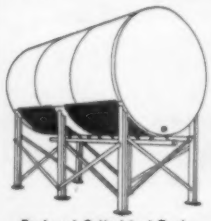
Open Cylindrical Tank

- Sturdy, Lightweight Construction for Long Operational Life.
- Easy to Remove Panelcoil for Cleaning or Replacement.
- Available in standard single and double embossed Panelcoil, in widths from 12" to 29"; in lengths from 23" to 143" flat or rolled to size to fit any tank. Standard Panelcoil made in "L"-grade carbon steel and type 316 "L" stainless steel. Also in Monel, Carpenter 20, Nickel, Hastelloy, Nionel and Titanium — up to 14-gauge for embossed stainless Panelcoil.



Open Rectangular Tank

- Easy to Calculate — Engineering cut to minimum with Dean's complete engineering data file.



Enclosed Cylindrical Tank

For Complete Data — Write for Data Sheet 15-60 Series, and Price Bulletin 259.

DEAN PRODUCTS, INC.
1047 Dean Street, Brooklyn 38, N. Y.
STerling 9-5400
Backed by 25 Years of Panel Coil Manufacturing

For more facts circle 521 on Reply Card

BACKTALK— FORETHOUGHTS

pects with another 25 per cent being from customers who can be converted into the former class.

"We are particularly delighted by the fact that we have not received a volume of 'junk' inquiries from your magazine. We have found that the requests for information which you have forwarded to us seem to be from owners of the very highest type.

"This is very important to us, as I imagine it is with any manufacturer, because sales calls are so very expensive and it is crushing to find that the person upon whom you are calling is someone with very little buying influence. Apparently you people have done an excellent job of screening your readership." *Richard M. Watt, Crossfield Products Corp., Roselle Park, N.J.*

Keeping Water Ice-Free

PLANT ENGINEERING:

"Please send me information regarding your article on page 143, June issue of PLANT ENGINEERING. The article is 'Water Surface Ice Melting-Aqua Therm Puts Btu's To Work.'

"We would like to know the address of the people who are promoting the equipment. We are especially interested in the Aerator mentioned in the article, to use in experimental waste treatment project. Please advise by return mail." *W. D. Gerlach, Director of Engineering, Green Giant Co., Le Seur, Minn.*

PLANT ENGINEERING:

"Please send us all information as to uses, technical data available, and suppliers of the Aqua Therm unit described in your June 1960 issue on pages 143 and 144." *James L. Hackett, Engineer—Maintenance, Shell Oil Co., Wood River, Ill.*

PLANT ENGINEERING:

"I have read your article concerning the Aqua Therm principle published on page 143 of your June, 1960 issue with considerable interest.

"Since our company is extremely interested in the problem of ice prevention, not only for ships' docks, but also for pulpwood holding ponds and the relief of ice pressure on the face of dams, we are most desirous of obtaining further information.

"I would appreciate very much if you could send me the name and address of the developers of this equipment, so that we could contact them for more technical data." *J. S. Forrester, P. E., Materials Handling Engineer, The Ontario Paper Company Limited, Thorold, Ontario.*

Transportation for Night Watchman

PLANT ENGINEERING:

"We are interested in a small electric cart to be used by our night watchmen in making their rounds. We would like the cart to be not more than 24 in. wide, a three wheel type.

"We would appreciate any information you could furnish on such a cart. Thank you!" *Charles Loucks, Maintenance Supervisor, Her Majesty Underwear Co., Maudlin, S.C.*

Power Costs Reprints

PLANT ENGINEERING:

"July, 1960 edition of PLANT ENGINEERING included an article very much of interest to us: 'Squeezing Power Costs,' pages 102 to 106. The majority of the recording instruments described in the article and pictured on page 103 are of our manufacture.

"If possible, we should like to purchase 50 reprints of the article. Also, we should like very much to have prints of the pictures appearing on page 3 for possible use in our direct mail publication, *The Graphic*. These pictures would be used within whatever limits you specify." *William Wirth, The Esterline-Angus Co., Inc., Indianapolis, Ind.*

▶ Cost of reprinting 50 copies of this article would be high, so we have sent Mr. Wirth 50 tear sheets, together with the photographs.—*Editors.*

Plant Engineering and Graphic Art

PLANT ENGINEERING:

"Enclosed is a rough page proof from the forthcoming educational handbook, 'Borders, Ornamentation, and Boxes,' by Kenneth B. Butler and myself, eighth edition in our series of Practical Handbooks on Publication Layout.

"The page proof contains a reproduction of a page from PLANT ENGINEERING to illustrate a point.

"Manner of presentation, rather than subject matter, is the point of emphasis, and the page selected from your publication will make a valuable contribution thereto.

"Accordingly, may we have your permission to reproduce in the manner indicated on the enclosed page proof and, for our files, a letter of clearance?" *George C. Likeness, Executive Director, Butler Typo-Design Research Center, Mendota, Ill.*

▶ Delighted.—*Editors.*

For more facts circle 522 on Reply Card ⟶

are you heating the **wrong half** of your building?*

* you won't if you use

Important Information Available!

Lennox Industries Inc. DEPT. I-A123
Marshalltown, Iowa

Gentlemen:

I am interested in the items checked below. Please mail complete information to me on . . .

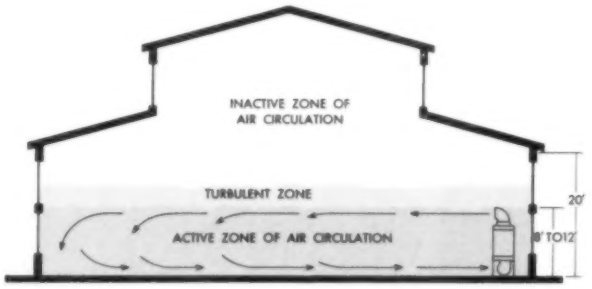
☐ Direct-fired industrial heaters
☐ Unit heaters
☐ Gas Duct heaters ☐ LENNOX APPLICATION MANUAL
(Industrial direct-fired space heaters)
☐ Have a LENNOX representative call

Name _____
Address _____
City _____ Zone ____ State ____

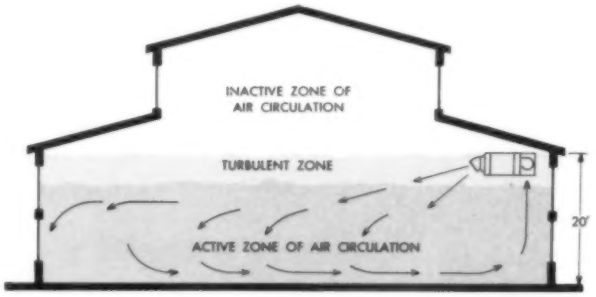
get the most heating . .

Important Information Available!

Most industrial buildings are hard to heat and have high heat losses. Usually the heating system simply dumps enough heat into the building to keep the work level near the proper temperature. This wastes heat, causes drafts, creates "hot spots" and causes high ceiling temperatures. Lennox industrial heaters overcome such faults. The large capacity blowers and low internal resistance of the heaters make it possible to discharge large volumes of high velocity air above the heads of the workers. This eliminates hot spots and levels temperatures in all parts of the building. By locating the Lennox heaters on the floor you get more air changes per hour because only the air in the active zone (work level) is circulated. Because Lennox units heat only the work level, a minimum floor to ceiling temperature gradient can be maintained. Keeping the ceiling temperature at a minimum and circulating only the air in the work area with Lennox heaters considerably reduces the cost of heating industrial buildings.



Floor mounted units provide air circulation at the working level. Air volume to be circulated is reduced, resulting in maximum number of air turnovers per hour in the active zone of air circulation.



Suspended heaters located at the roof line must handle larger volumes of air in order to provide the same number of air turnovers compared to floor mounted equipment.

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD
FIRST CLASS PERMIT NO. 53 MARSHALLTOWN, IOWA

LENNOX INDUSTRIES INC.
DEPT. I-A123
MARSHALLTOWN, IOWA

Postage Will Be Paid by Addressee

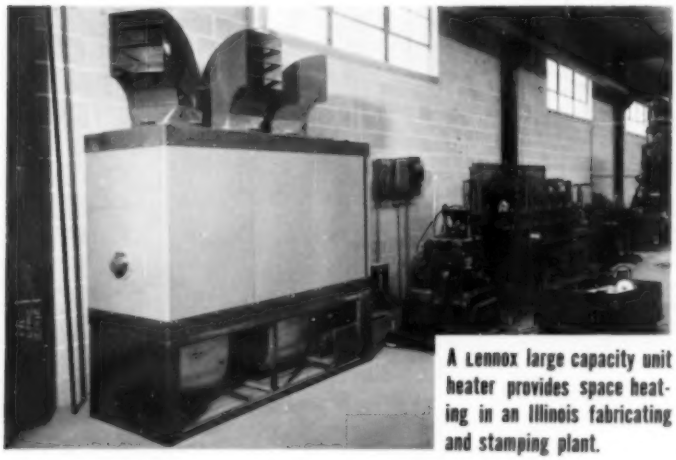
. . . with the least expense with LENNOX space heaters

- direct-fired vs "wet" industrial heating
- heating and air conditioning
- make-up air and ventilation
- process work

* space heating

A Nebraska manufacturing company provides space heating and ventilation with Lennox large capacity unit heaters suspended from the ceiling. NOTE the old junked unit heaters in the foreground.

Lennox was chosen as replacement equipment for three reasons. The old unit heaters supplied enough spot heating for the previous use of the building, but would not provide sufficient heat when the building usage was changed. Now Lennox heaters provide uniform wall to wall coverage with no "hot spots". These units are equipped with both make-up air dampers and dual fuel burners. The air exhausted from the building is replaced by the heater rather than by infiltration of cold air. Considerable fuel cost reduction is realized with the dual fuel burners on the Lennox heaters. The plant is now on a money saving, interruptible gas supply rate not possible with the old heaters.



A Lennox large capacity unit heater provides space heating in an Illinois fabricating and stamping plant.

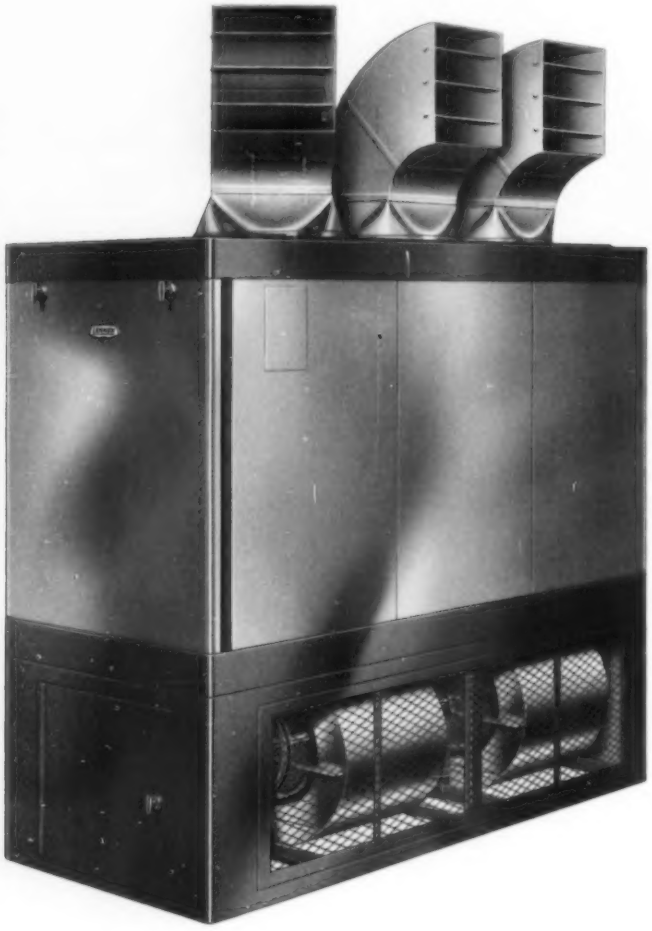
Lennox units were chosen for this job primarily for their large air handling capacity and their good service record in previous installations. The heaters are located along the outside wall and provide uniform temperature control over the entire building width. These units are oil fired with stack controls.

LENNOX

Commercial Equipment

LENNOX direct-fired unit heaters

A NEW BURNER CONCEPT . . . MANY FUEL CHOICES PLUS INSTANT CHANGEOVER . . . THREE CONTROL CHOICES: ON-OFF, HI-LO-OFF, MODULATING



Automatic Changeover
A flip of a switch changes to standby fuel. No burner changes are required. One burner fires all fuels.

Integral Burner Design
"OG" burners are an integral part of the unit. For gas, oil or dual fuels.

Heat Exchanger
Meets U. L. requirements when subjected to 180°F. rise over stainless primary and aluminized secondary surfaces. No internal baffles.

Single Motor Operation
One motor operates fuel unit when required, also induced draft and combustion air blowers. Combustion air is pre-heated.

Quiet Running Blowers
Move large volumes of air at office-quiet sound levels. Motor mounted on adjustable rails. Blower capacity and low internal resistance mean good adaptability to air conditioning.

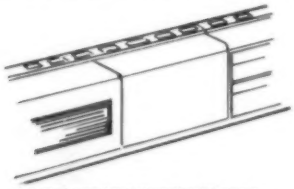
Floor, Suspended Mounting
Designed to mount in any position: up-flo, down-flo or horizontal-flo, with or without service platforms.

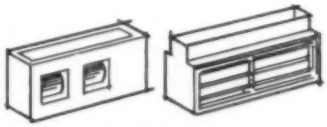
Master Program Controls
Enclosed to prevent tampering or damage. Fireye electronic safety controls standard on all units. Stack control optional on oil units.

FULL LINE . . . A UNIT FOR EVERY JOB

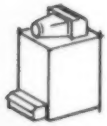
CENTRAL FURNACES

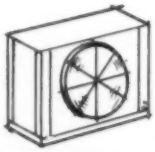
UNIT HEATERS

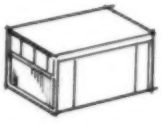

COMFORT CURTAIN CLASSROOM EQUIPMENT

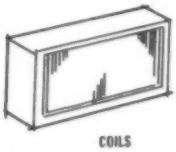

BLOWERS AND DAMPERS

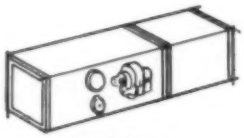
LANDMARK BLOWER-HEATER-COIL UNITS


DUCT FURNACES


CONDENSING UNITS


HEAT PUMPS


COILS


SUSPENDED UNITS

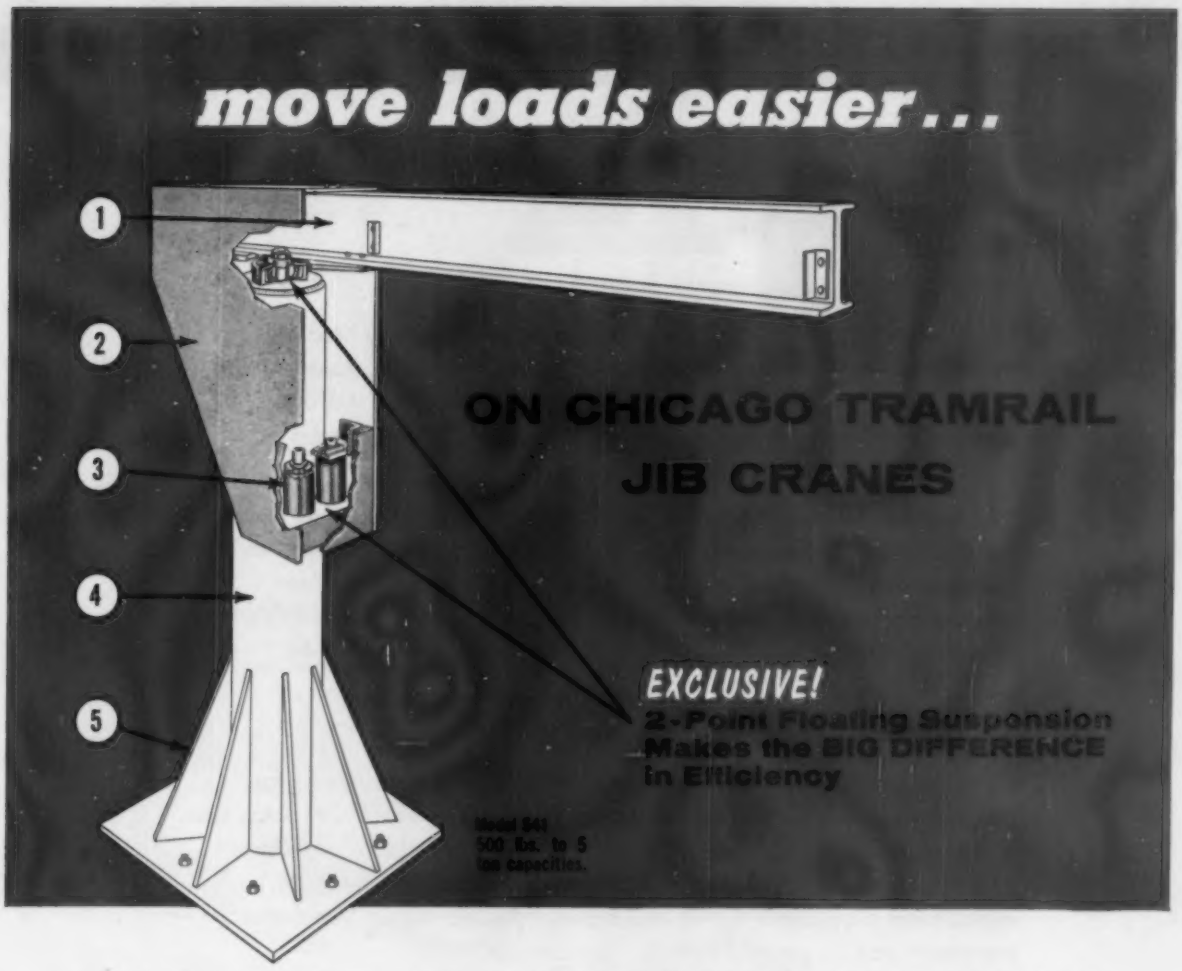
LENNOX Industries Inc.

LITHO U. S. A.

MARSHALLTOWN, IOWA • COLUMBUS, OHIO • SYRACUSE, N.Y. • FORT WORTH, TEXAS • LOS ANGELES, CALIF. • SALT LAKE CITY, UTAH
DES MOINES, IOWA • DECATUR, GEORGIA • LENNOX INDUSTRIES (CANADA) LTD., TORONTO, ONTARIO • CALGARY, ALBERTA

FORM NO. IND.-605-M6

move loads easier...



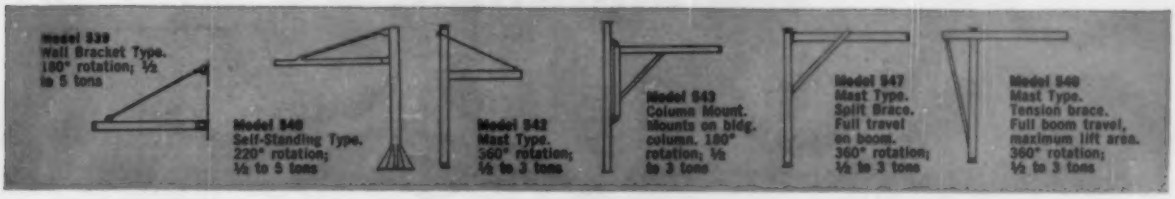
1. **High carbon, hydraulically straightened Beam designed to accommodate heavy duty electric hoists.**
2. **Rigid box construction to insure minimum deflection.**
3. **Bottom roller assembly adjustable for leveling boom.**
4. **Heavy seamless steel column.**
5. **Numerous heavy steel gusset plates welded to column and base provide accurate alignment between column and base.**

Free and easy boom swing is a designed-in characteristic of every Chicago Tramrail Jib Crane. For example, the 2-point suspension used in the Model 541 Jib Crane literally floats the boom through its 360° swing — makes heavy load handling a fast, easy job.

Two bottom load carrying rollers, equipped with heavy duty precision ball bearings, engage and bear on the surface of the vertical column; the top bearing is a precision radial and thrust bearing. This combination assures minimum drag and free boom rotation.

All structural and mechanical parts of Chicago Tramrail Jib Cranes are designed to withstand loads which include heavy duty electric hoists and 25% impact. Every detail of these cranes is designed and built to insure fast, efficient, and safe load handling. That's why you see more Chicago Tramrail Jib Cranes at work . . . and more being installed every day.

Chicago Tramrail Jib Cranes are made in more than 12 types; capacities to 7½ tons, spans to 22 ft., with heights and mounting details to suit your application. Write for complete Jib Crane Catalog.



CHICAGO TRAMRAIL CORPORATION
1324 SOUTH KOSTNER AVENUE, CHICAGO 23, ILLINOIS

For more facts circle 523 on Reply Card

"Here at HONEYWELL we're control men

Honeywell
H First in Control

"We have a basic philosophy here at MINNEAPOLIS-HONEYWELL. As control specialists, we've learned that it is our *specialist's approach* to design, installation and service that enables our controls and instruments to do their best in operation.

"We feel the same way about elevators. We have 4 OTIS Passenger Elevators and 6 OTIS Freight Elevators in our Minneapolis plants. We know that they'd end up as strangely *mixed breeds* if we attempted their maintenance—because a careful study of the OTIS *specialist's approach* to maintenance has convinced us that only OTIS can keep our elevators running like new."

What is the OTIS *specialist's approach* to elevator maintenance?
It is MEN . . . MATERIALS . . . METHODS.

MEN: Elevator maintenance is no one-man job. It is an organization task requiring experts in many lines. No individual, even if he devoted his entire time to the job, could do it properly. It calls for men with an unusual combination of skills plus long OTIS training in studying parts, assemblies, functions, replacement procedures, testing and adjusting. Some degree of elevator complexity can be gleaned from the illustration at the right.

MATERIALS: Original OTIS parts and specially designed OTIS maintenance equipment are within one hour of 90% of all OTIS elevators in the U. S. for use in scheduled replacements—and to hold emergency shutdowns to a minimum.

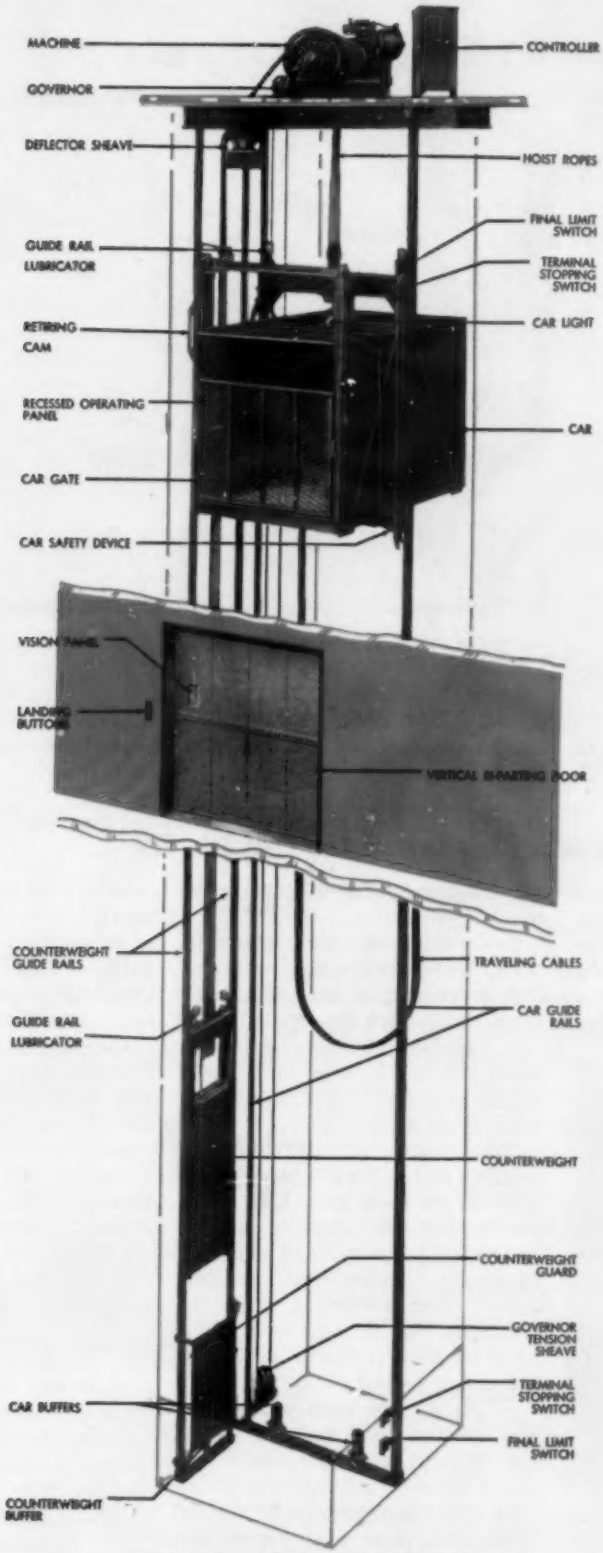
METHODS: With more than 40,000 elevators under OTIS maintenance, OTIS has developed an actuarial procedure that replaces wearing parts well in advance of their breakdown point to hold shutdown to an absolute minimum and assure the highest possible safety.

elevator maintenance
THAT KEEPS ELEVATORS RUNNING LIKE NEW

OTIS

OTIS ELEVATOR COMPANY • 260 ELEVENTH AVENUE • NEW YORK 1, N.Y.
OFFICES IN 297 CITIES ACROSS THE UNITED STATES AND CANADA

. . . not elevator maintenance men"



For more facts circle 524 on Reply Card

PLANT ENGINEERS' DIGEST®—so those who rush may read and know what's new

Edited by Marjorie E. Weissman

High-Level Lighting Boosts Production as Well as the Quality of Delicate Meters

CONTROLLED ENVIRONMENT combined with lighting levels of 300 ft-c, has boosted quality 100 per cent, output 50 per cent and cut production costs 20 per cent at the Hickok Electric Instrument Co., Cleveland, Ohio.

The room is pressurized at a constant level. With 4 psi higher pressure than other areas, dust is kept from entering windows and doors, temperature is held at 75 F and humidity at 45 per cent.

A luminous ceiling provides well diffused, high-level lighting to the modern desk-like assembly line where delicate meters are produced for aircraft, missiles and space vehicles. The eye loupes formerly required for the assembly work need now be used only for final visual checks.

Lighting is provided by continuous rows of two-lamp, 8-ft, cool white, high output lamps used behind a vinyl plastic ceiling. The area is approximately 30 ft by 50 ft with a 10-ft ceiling. Reflectances are 70 per cent for the walls, 20 per cent for the bench tops and 10 per cent for the floors. *From a release of General Electric Co., Cleveland, Ohio.*

Luminous ceiling in controlled environment room gives lighting level of 300 ft-c.

Special Eye-Catching Cigarette Containers Help Smokers Keep Plant Safe, Neat

WHEN REPUBLIC Aviation Corp. approved smoking in its Farmingdale, L. I. plant, the need for cigarette butt containers was obvious, but finding the right kind was a headache. Office-type urns were too expensive and failed to stand up to rough shop service.

On entering No Smoking area, worker uses specially-designed cigarette pail.

Following Republic's specifications, a 5-gal, 26-gage steel pail was developed. A red, white and black design with the words "Cigarette Ends" in red letters on a white panel, was silk-screened on it, making the container's function obvious and eye-catching.

Total cost of the pail including painting and a rust-inhibiting lining is under 90 cents each. Like many plants, Republic receives a wide variety of products from suppliers in similar 5-gallon pails, and had earlier tried converting these for cigarettes, but cleaning in a stripping solution and repainting with the design proved costly.

Republic tops each pail with a shallow wire cone designed to admit cigarette ends but screen out paper and other inflammables. Filled with sand, the assemblies are spotted around the plant in appropriate locations, with extra cans in areas of heaviest travel and at the margins of no-smoking areas. Simple availability of the containers insures their use, with marked improvement in safety and plant cleanliness.

Cleaning is handled easily with a simple strainer device. Experience with the butt cans has been so satisfactory that Republic now also uses similar cans, painted the same as its 55-gallon rubbish drums, as wastepaper baskets in the plant areas. *From a release of Jones and Laughlin Steel Corp., Pittsburgh, Pa.*

Metal Finger Detects Reversed Roller Feeding

A DEVICE TO DETECT the reverse feeding of tapered rollers into roller grinding machines has been installed at our Columbus, Ohio, Railway Bearing Plant.

The device, a metal finger, is a

(Continued on page 42)

"Explosion-proof EXIT *signs!*

Where do you expect me to get them?"

As you can see, they found the explosion-proof exit sign. It's Crouse-Hinds No. EVA139.

Look in your Crouse-Hinds catalog, of course. There's nearly everything you could want for hazardous areas listed there. Nine different types of explosion-proof telephones... horns, bells, clocks, pilot lights, instrument enclosures, gauge lights. Even X-Ray film illuminators. And, of course, modern designs in all the familiar explosion-proof motor controls, switches, plugs, receptacles, panel boards and lighting fixtures. UL-listed for every Class and Group in Article 500, National Electrical Code.

So, whether you're looking for conventional or out-of-the-ordinary explosion-proof electrical devices, contact Crouse-Hinds. If you design, buy or work with hazardous-area equipment, a Crouse-Hinds catalog should be on your desk. Ask your Crouse-Hinds Representative.

CROUSE HINDS
SYRACUSE NEW YORK

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For more facts circle 525 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

supplement to the roller feeding line and prevents reversed rollers from entering the machine. The smaller end of the tapered roller must enter the grinder first. When it reaches the metal finger, the finger rides up the taper and drops back in position. If the roller is reversed, the large end of the taper hits the finger and is stopped. It is then removed by hand and the operation continues.

Prior to the installation of the new device, a roller would occasionally reverse itself as it came into the conveyor which feeds the grinder. When it entered the loading tube, it jammed the loading fixture. The machine had to be stopped so the reversed roller could be removed.

On occasion, a roller would enter the grinder in a reversed position, resulting in damage to the feed wheel and to the grinding wheel. Production had to stop while repairs were made.

This new method of detection has eliminated this type of production stoppage, which means considerable savings in downtime and reduction in maintenance. *From a release of Timken Roller Bearing Co., Canton, Ohio.*

Metal finger quickly detects reversed rollers feeding into the roller grinders.

Winter Operation of Cooling Towers

WHEN AIR conditioning systems require the use of cooling towers or evaporative condensers during winter weather, ice formation and freezing damage can be minimized by simple changes in the method of operation. Three schemes for winter operation are suggested:

a. Normal circulation with both sprays and fan in operation.
b. Sprays on but fan off.
c. Neither sprays nor fan operating. Water flow is bypassed through the pan of the cooling tower.

Some installations make use of all three of the above procedures at different times. Or, the procedures are modified by using the cooling water temperature to control a thermostatic valve which varies the amounts of the circulating water going to the sprays and to the pan.

The prevention of freezing in exposed circulating water lines when the tower or condenser is not being operated can best be accomplished by mechanical methods. One technique is to use a dump or surge tank indoors. The equipment is arranged so that every time it is shut down or every time the water temperature falls below a specified minimum, say 35 F, the contents of the outside portions of the system drain into the surge tank.

In such installations during winter operation, cooling tower pan or evaporative condenser does not contain the same depth of water as during summer operation. Instead, the pan drains completely as soon as the circulating water flow is shut off.

A second technique for protection of exposed water lines from freezing is to wind about them thin copper steam tubing or electrical resistance wire, and to cover this with insulation. The lines can then be heated by steam or electricity, controlling the application of the heat with a thermostat or valve located at the coolest spot in the system.

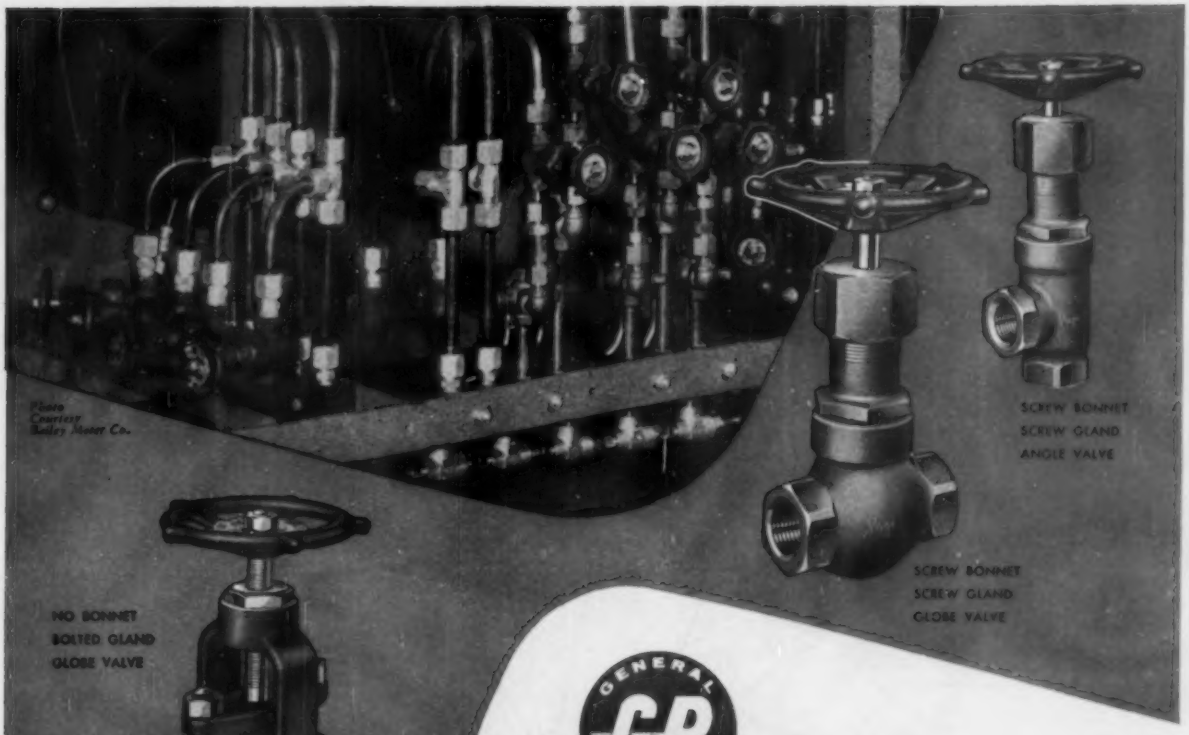
Such installations are generally set to start the heat when the water reaches about 35 F and to shut it off when the water gets to about 40 F. It is usually not necessary to protect the cooling tower pan since the formation of ice in it will cause no damage, although the pan can be heated by the same method in order to insure against freezing completely.

The addition of glycol anti-freeze is not entirely practicable, for under certain conditions the glycol may react with chemicals that have been added to the cooling water for pro-

(Continued on page 44)

Cut Work Space 50 Per Cent With Modular Bins

Use of modular parts-bins in two sizes mounted on "lazy susan" has cut bench space used by operators nearly 50 per cent at Allen B. Dumont Co., Clifton, N.J. (From a release of Bathey Manufacturing Company, Plymouth, Mich.)



GENERAL GP PURPOSE

FORGED STEEL *INTEGRAL SEAT* METER AND GAUGE LINE VALVES

Union Bonnet, Screw Bonnet and No Bonnet Types

Service proved Vogt GP Forged steel valves are the choice of leading meter and gauge Manufacturers for top performance and unfailing reliability.

They are available in sizes from ¼" to 2" of carbon steel for general purpose duty and of all-stainless where highly corrosive liquids are involved. All stems are one-piece 13% Chrome Stainless Steel with fine pitch threads for accurate regulation of flow. Special packing is furnished when specified.

Catalog F-10 contains the complete Vogt line of valves, fittings, flanges and unions. Available upon request on your letterhead. Address Dept. 24A-FPLE

HENRY VOGT MACHINE CO., P. O. Box 1918, Louisville 1, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Los Angeles.

Vogt FORGED STEEL VALVES, FITTINGS, FLANGES and UNIONS

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"Call FOSTER for track... PLUS"

Whether you call for a big shipment of "high iron" or a single guard rail, Foster gives you track "plus"—all the rail you need, and all the accessories and tools to complete the job.

You can get any standard rail sections including lower-cost Foster Quality Relayers, frogs, switches, tie-plates, accessories, tool cars and dollies, hand tools, gauges, levels and other track items including CRANE RAIL. We will also supply steel-sheet piling and construction products for maintenance-of-way.

Another "plus": Foster's warehouses are located all over the country, all carry large stocks. So you get the advantage of "complete package" shipments, lower freight rates, prompt deliveries. For assistance in ordering, call the Foster Track Specialist near you.

Write **L. B. FOSTER CO.** for Track Catalog PE-10
Pittsburgh 30 • New York 7 • Chicago 4 • Houston 2
Los Angeles 5 • Atlanta 8 • Cleveland 35

Faster From Foster

Pipe · Piling · Rail

For more facts circle 527 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

tection of the equipment against corrosion or scale formation. Special measures are needed to keep enough glycol in these cooling systems to be effective and these measures may make its use costly. *From a release of Water Service Laboratories, Inc., New York, N.Y.*

Neat Feat

At Northrop Aircraft, Inc., air hammer is used with hose that stretches, recoils like telephone cord. Hose has quick-disconnect fittings for use with portable tools. (From a release of Nycoil Company, Westfield, New Jersey.)

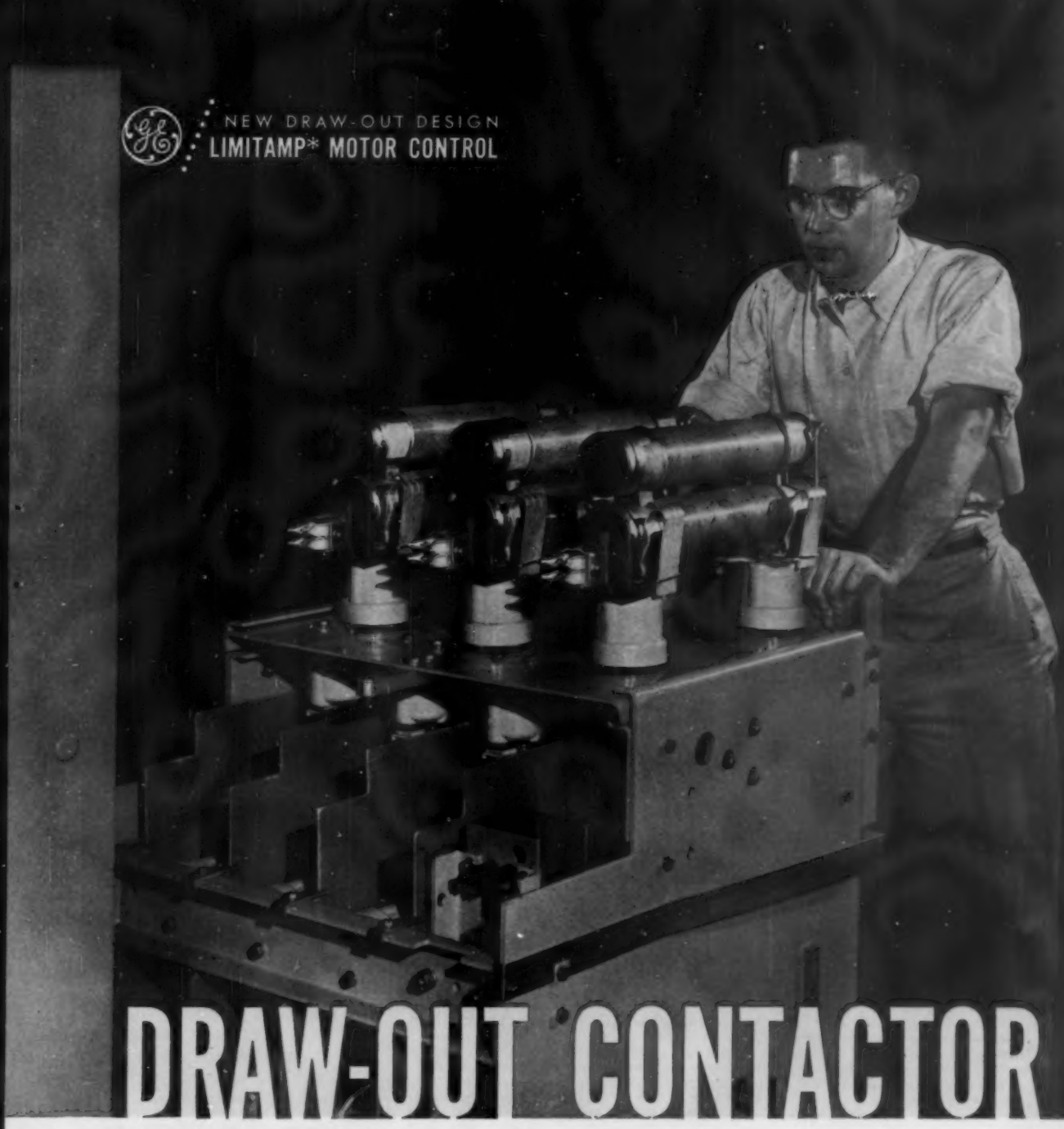
Lead Pellets Keep Wall in Place

LEAD PELLETS were used in a building in Montgomery, Ala., to space cast stone blocks and equalize bearing stresses, thus preventing mortar joints moving from the true horizontal or vertical.

Set in place after the mortar had been applied to the block, these pellets, two to four of them depending on location and bearing stress, take the weight of the masonry above, deforming just enough to bring them all into bearing. Should slight foundation movements shift the balance of the load, the pellets will flow a bit so that any local stress concentrations will not crack the wall.

About 2000 pellets were used to wedge stone anchors tightly into the

NEW DRAW-OUT DESIGN
LIMITAMP* MOTOR CONTROL



DRAW-OUT CONTACTOR

. . . cuts Limitamp control installation time

Rated 2300- to 4600-volts for a-c motors up to 3000 hp.

A draw-out contactor which automatically connects or disconnects as it is rolled in or out of the enclosure!

This is just one of the revolutionary design features in General Electric's new Limitamp motor control . . . a new design which cuts installation time in half!

During installation the contactor is easily withdrawn, leaving ample room to enter the enclosure, pull both motor and incoming power cables and make connections. When cables are connected, barriers are placed in position to seal off incoming line cable and a-c bus. The motor cable—located in its own raceway—is completely accessible when the starter is de-energized.

As the contactor is rolled back in, stab-on contacts automatically plug into the de-energized power circuit. At the same time, control power is automatically engaged. Installation time is held to a minimum.

Ask your G-E Apparatus Sales Engineer about other advanced-design installation, operation, performance and maintenance features of new Limitamp control. Or, write Sect. 783-11, General Electric Co., Schenectady, N. Y. for Bulletin GEA-6893. Industry Control Dept., Salem, Va.

Progress Is Our Most Important Product

GENERAL ELECTRIC

* Reg. Trade-mark of General Electric Company

For more facts circle 528 on Reply Card

Now—A *unitized* power pack for *maintenance free* switchgear tripping and control!

Utilities and industrial plants can greatly increase their margin of reliability and protection for switchgear and control equipment by using C & D's *AutoCal** *unitized* Power-Pack.

Here's a dependable, high-capacity power package specifically built for tripping and control that pairs a simple, compact, C & D *AutoReg*® Silicon charger with powerful, lead-calcium grid control batteries. No adjustment or manual switching is required.

The charger is a completely automatic, constant voltage, current limiting unit. It regulates DC output voltage within ±1% in floating range over an AC input variation of ±10%. The silicon rectifying element has no known aging characteristics. Consequently, there are no aging taps and the attendant adjustment of these is eliminated. *AutoCal* has no moving parts and it utilizes a standard 115 volt, 60-cycle, single phase outlet as a power source.

PlastiCal® batteries** have extra thick positive plates (0.266"). They provide a high one minute rate. Lead calcium grid batteries require 1/5 to 1/10 as much current to maintain a fully charged condition as do conventional batteries. Consequently, there is so little electrolysis of water occurring that the batteries need be watered only once a year.

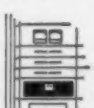
The combination of a C & D *AutoReg* charger and *PlastiCal* battery gives you self-protected charging . . . instantaneous peak power on demand . . . and long trouble free life.

Get the full details—write for Bulletin AR-102 today!

CHOICE OF MOUNTINGS

CUBICLE MOUNTING. Most popular method mounts *AutoCal* on the door of associated breaker cubicle.

WALL MOUNTING. Charger may be wall mounted near bank of indoor switchgear.



RELAY RACK MOUNTING. Charger is available with front panel for standard 19" relay rack.

WEATHER-PROOF OUTDOOR MOUNTING. Both charger and batteries fit in a weather-proof cabinet for use with outdoor switchgear.

C&D C & D BATTERIES
of Conshohocken, Pa. . . . Attica, Ind.
DIV. THE ELECTRIC AUTOLITE CO.

Manufacturers of Slyver-Clad® Industrial Batteries • PlastiCell* and PlastiCal® Batteries for Communications, Control, and Auxiliary Power • Producers of AutoReg® Silicon Chargers and AutoCal* Charger-Battery Combinations

**Trademark, C & D Batteries Div. The Electric Autolite Co.*
***Designed for 25 year life*

For more facts circle 529 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Tiny lead pellets, arrow, are used to keep cast stone wall properly aligned.

½-in. reglet cast into the top edge of the stone. Anchors ⅛-in. thick allow for any adjustment needed in anchoring the blocks to the wall behind them. The lead pellets offer a quick and permanent way of adjusting the anchor position. *From Lead, published by Lead Industries Association, New York, N.Y.*

Handy Lockers

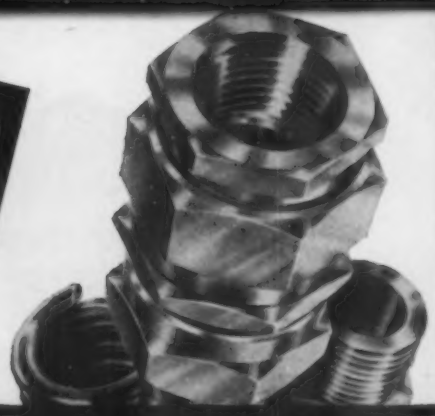
A RECENT INSTALLATION of employee lockers in the Newark, Del., automobile assembly plant of Chrysler Corp. was planned to fill a need for simplified maintenance, improved security, and easier access from working areas.

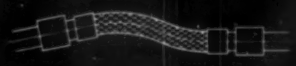
Convenient location was impor-

Lockers are installed near work areas.

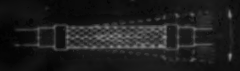
Flexonics PMS

NEW, BETTER WAY TO SOLVE ANY PIPE MOTION PROBLEM

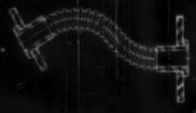




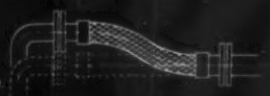
Solving shock motion and misalignment on drop forge.



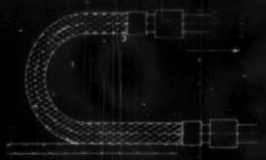
Preventing valve damage, vibration stress on compressor.



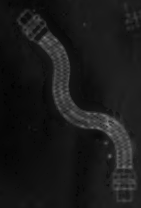
Solving piping space problem on de-waxing filter.



Correcting for thermal growth on coke oven gas connectors.

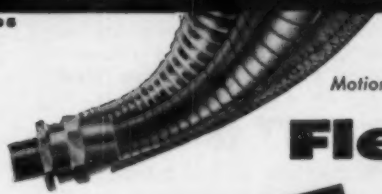


Correcting for reciprocating motion on single platen press.



Correcting for random motion on asphalt feed-line.

IH396



For expert service on all Pipe Motion Problems call your authorized

Flexonics

PMS SPECIALISTS

For more facts circle 530 on Reply Card

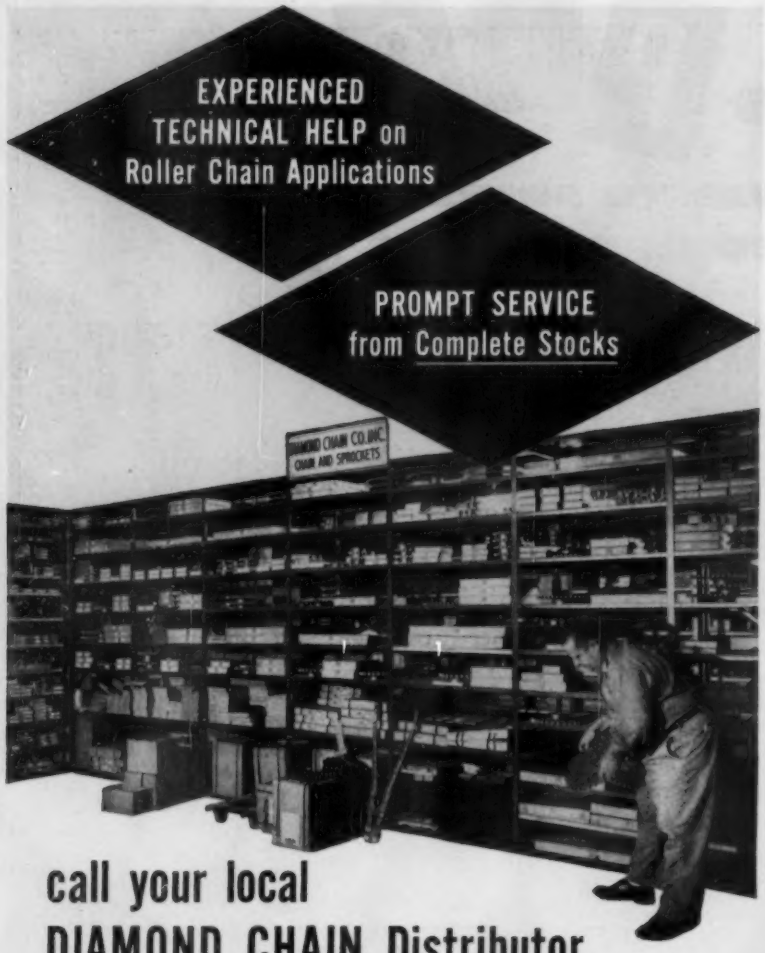
The one sure way to receive expert counsel on any *pipe motion problem* is to call your Flexonics PMS distributor. He is thoroughly experienced in all flexible metal hose applications. Let him analyze your need and make recommendations. He carries a broad metal hose inventory . . . has the facilities for fabricating *complete assemblies* to your specifications. This means *quick* . . . responsible service from one *local* source. Find him in your telephone directory under "Hose" or "Hose, Metal". . . or write

Flexonics corporation

1316 South Third Avenue, Maywood, Illinois

SUBSIDIARY OF CALUMET & HECLA, INC.

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ont.



call your local DIAMOND CHAIN Distributor

Your DIAMOND Distributor can help you work out efficient, cost-cutting roller chain installations for power transfer, precision timing and conveying applications. He has, *in stock*, a good selection of DIAMOND roller chain and sprockets. He maintains large stocks of spare parts—connecting links, roller links—individually packaged in weatherproof, transparent plastic bags for easy shelving and identification.

Coast-to-Coast Sales and Service—Call your DIAMOND Distributor for *prompt service* for all your roller chain needs. Look under "Chains" or "Chains, Roller" in the Yellow Pages of your phone book . . . or write direct to DIAMOND for his name.

Catalogs and Engineering Service—Your DIAMOND Distributor can supply you with catalogs giving full information on roller chain and sprockets. Factory engineering service on special problems is also available through your DIAMOND Distributor.

DIAMOND CHAIN COMPANY, INC.
A SUBSIDIARY OF AMERICAN STEEL FOUNDRIES
Dept. 614 • 402 Kentucky Avenue, Indianapolis 7, Indiana
Offices and Distributors in All Principal Cities

DIAMOND ROLLER CHAINS ®

Find Your Nearest Distributor in The 'Yellow Pages'

For more facts circle 531 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

tant, so the lockers were placed in clusters throughout the plant. Each cluster is situated near a working area; thus employees may quickly reach their clothes and personal items. All lockers are the two-person type. Full height, they take half the space of a single unit locker. This feature was important due to limited floor space.

Good ventilation was another requisite. All lockers have large, grilled openings in the doors to admit air. The grill openings, in addition, provide a means of carrying out routine inspections, made to insure sanitation and also to discourage the storage of tools and parts away from their customary locations.

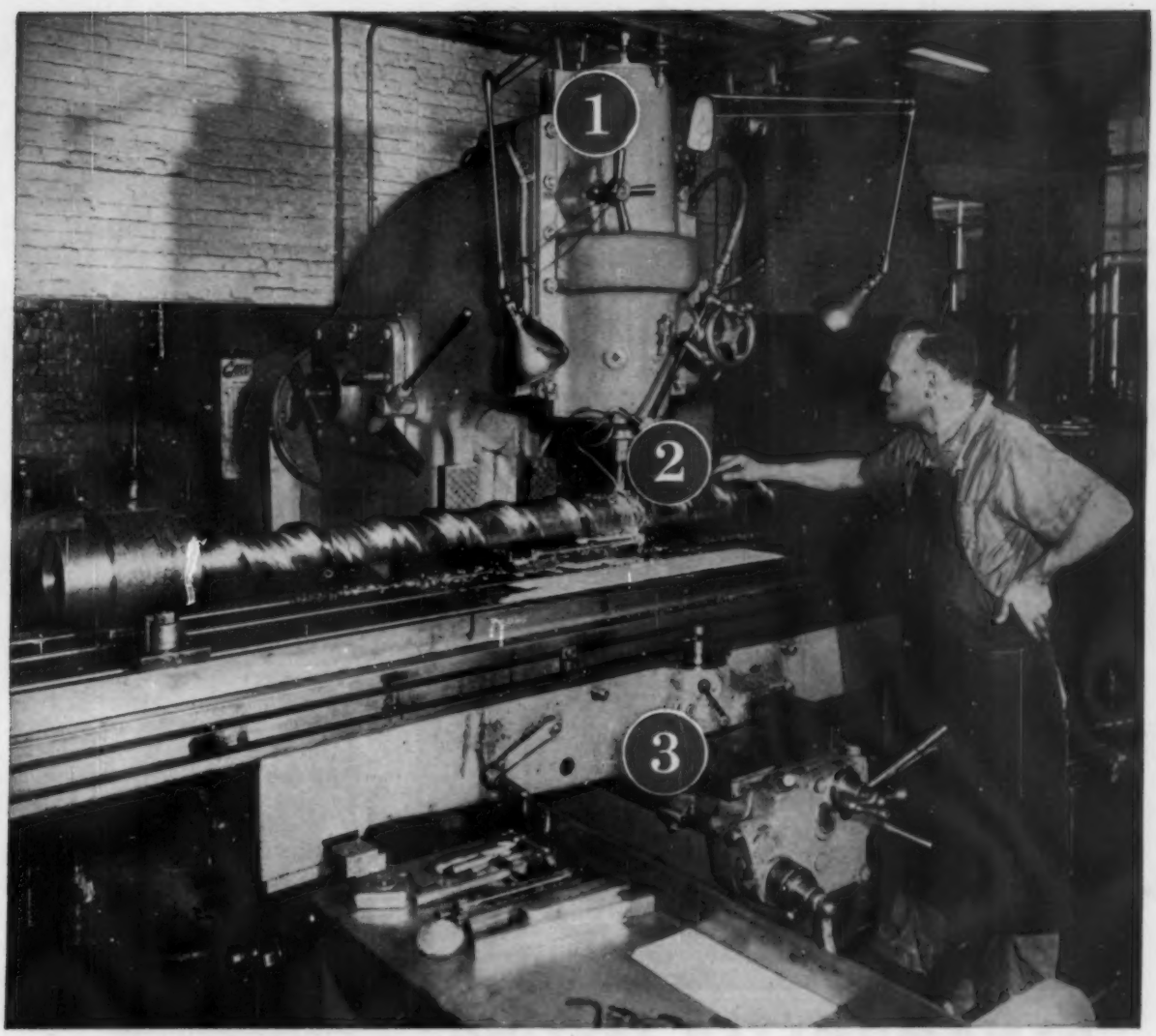
Housekeeping is simplified since the lockers' sloping tops prevent the accumulation of trash. *From a release of Penco Div., Alan Wood Steel Co., Oaks, Pa.*

For Better Heat Treating

Spacer springs of die steel inserted top and bottom of coiled thin-gage aluminum sheets help prevent warpage, weak spots, other damage during heat-treating cycle. (From a release of Boeing Airplane Co., Seattle, Wash.)

New Theory of Iron Rusting

SCIENTISTS at our research laboratories have suggested that corrosion in iron is caused by hydrogen ions, or protons. In a series of experiments that eliminated conditions required for electrochemical reactions, the complex rusting of iron was reduced to its simplest atomic



IMPROVING FEEDS AND FINISHES... WITH ESSO LUBES

1. NEBULA® EP GREASE helps bearings run true longer . . . maintains precision running of plain and anti-friction bearings. Exceptional for its stable consistency, oxidation resistance and load-carrying ability throughout a wide temperature range.

2. KUTWELL® EP 66 CUTTING OIL speeds fine finishes . . . increases tool life; permits higher speeds and deeper cuts. Leaves an easy-to-see film for highly efficient lubrication. Contains a bactericide to keep emulsions sweet smelling and serviceable for longer periods.

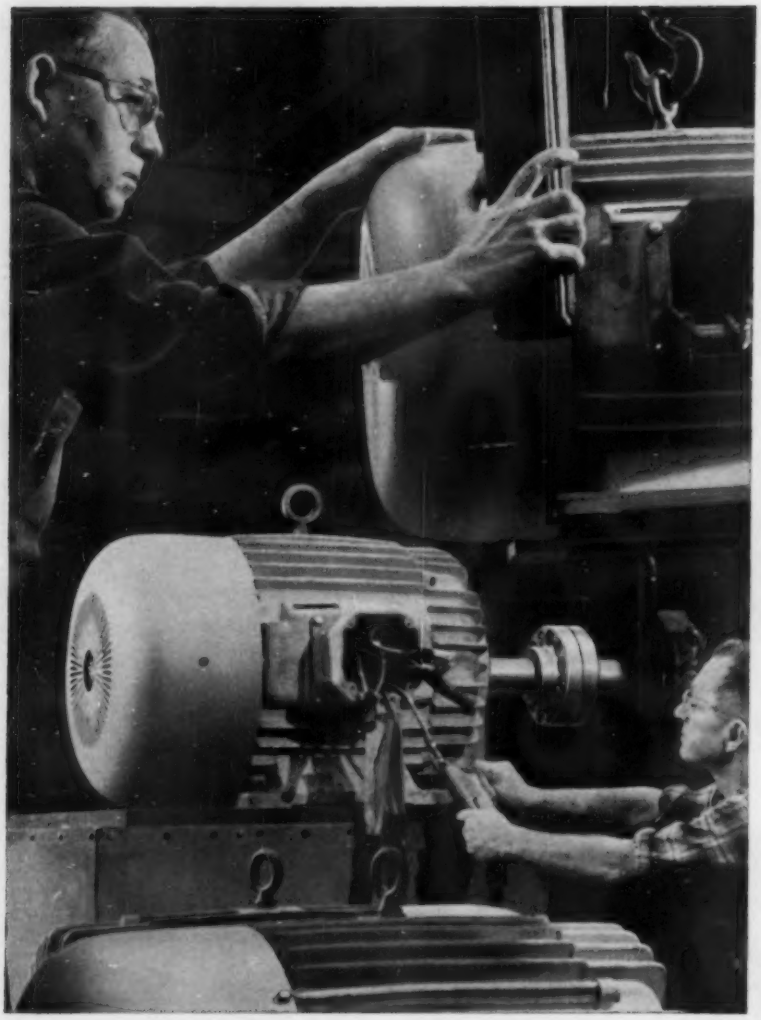
3. FEBIS® K LUBRICANTS insure smooth-sliding ways . . . boost precision by eliminating "stick-slip" movement. These lubes actually make static friction less than sliding friction; easily pass the stick-slip test.

There's a complete line of specialized Esso Lubricants to help improve your operations. Contact your local Esso office or write: Esso Standard, Division of Humble Oil & Refining Company, 15 West 51st Street, New York 19, New York.

Esso

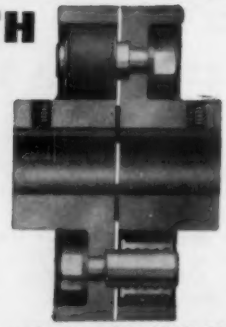
In Industry after Industry..."ESSO RESEARCH works wonders with oil"

For more facts circle 532 on Reply Card



DYNAMOMETER TESTING TIME SAVED WITH AJAX FLEXIBLE COUPLINGS

Hours are saved by one of America's foremost motor manufacturers because of the quick hook-up made possible by AJAX Flexible Couplings. Their quick connect and disconnect provides practically instant engagement and disengagement between motors and dynamometers.



Cross Section of AJAX Rubber-Cushioned, Sleeve Bearing Coupling.

AJAX Rubber-Cushioned, Sleeve Bearing design also saves line-up time and eliminates end-float problems. Motors being tested range from 40 to 150 HP.

Write for complete information on AJAX Rubber-Cushioned and Dihedral Gear Type Couplings.

AJAX

AJAX FLEXIBLE COUPLING CO. INC.

100 Portage Road Westfield, N. Y.

Representatives in Principal Cities

IN CANADA – The Alexander Flack Ltd., Ottawa

For more facts circle 533 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

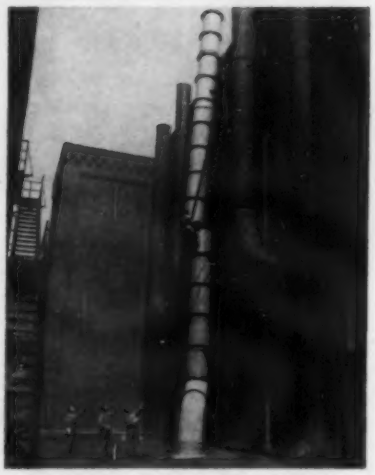
processes. Pure iron wires about the thickness of a fine sewing thread, were reacted with oxygen and water vapor at high temperatures (835 F) under closely controlled conditions. The resulting minute scale corrosion was studied under an electron microscope.

The scientists report that with dry oxygen the iron forms a protective oxide coating from which grow billions of tiny round oxide whiskers less than one-millionth of an inch in diameter and 30-millionths of an inch high.

The wires were then reacted under identical conditions except that water vapor was substituted for the dry oxygen atmosphere.

As a result of the experiments, two control measures which must be considered in addition to electrochemical effects that are involved in iron rusting, have been identified: Hydrogen must be prevented from entering the metal, and the growth of localized reaction sites must be inhibited by the addition of suitable alloying elements to the iron. *From a release of Westinghouse Electric Corp., Pittsburgh, Pa.*

Rigid Plastic Stack Exhausts Corrosive Fumes



Rigid vinyl stack that will exhaust corrosive fumes from automatic plater, is swung into place. Stack, 36 in. diam, ⅛-in. thick, is expected to last approximately 15 years. (From a release of B. F. Goodrich Company, Akron, O.)

(Digest continued on page 290)

Joy design means:

ADJUSTABLE BLADES

THE MOST EFFICIENT MEANS FOR VARYING FAN OUTPUT

Blade pitch on Joy Axivane Fans can be adjusted very easily. This means that the output of the fans can be varied over a range of ±20% without loss of fan efficiency, and therefore with minimum power consumption. And there are no efficiency losses such as are encountered with dampers and variable inlet vanes. (Where efficiency losses may be tolerated, the volumetric output may be changed by as much as 400%.)

Ventilating system efficiency is increased with Joy vaneaxial type fans, since they maintain the straight-through flow of air. Motors are mounted inside the fans and the fans become part of the ductwork. This direct drive also saves space and installation costs.

Joy Axivane Fans are designed to provide top performance in moving air, particularly where large volumes or high pressures are involved. The adjustable blade feature can save you a great deal of money in situations where the air requirements fluctuate, or are difficult to calculate. For complete details, write for Bulletin 1216-15.

Blade pitch can be adjusted by loosening one nut, re-setting blade to desired position on the calibrated scale, and retightening the nut.

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

JOY

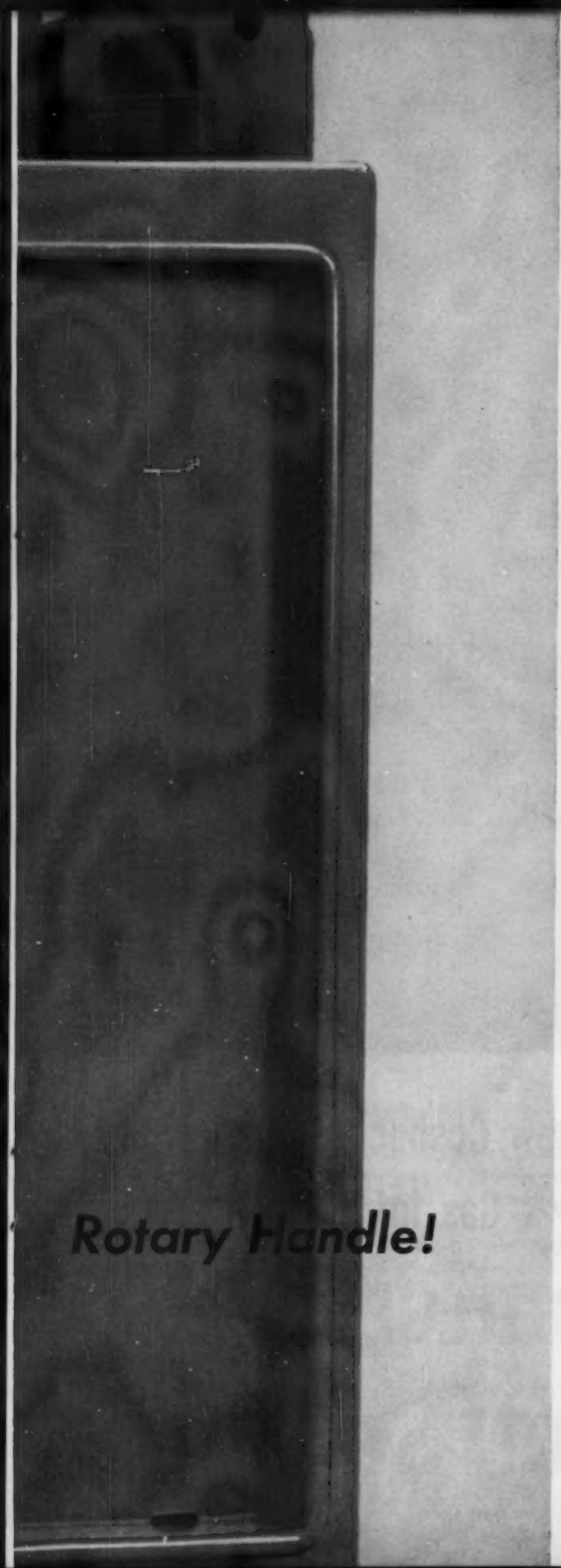
Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

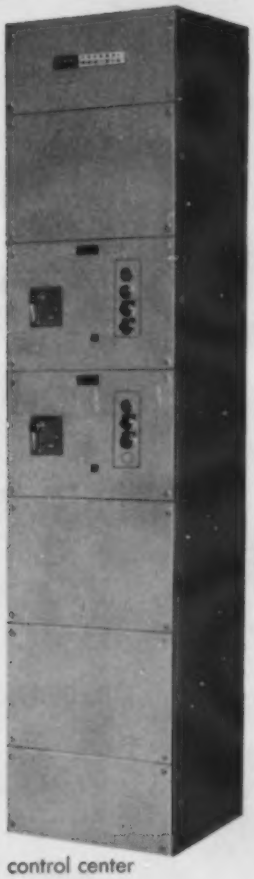
For more facts circle 534 on Reply Card

For more facts circle 535 on Reply Card ——→

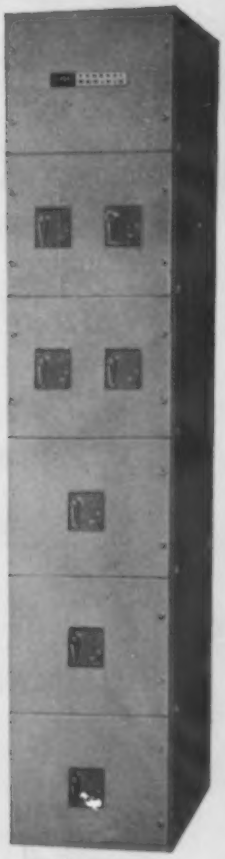
15
RESET
OFF
TRIP
ON



Rotary Handle!



control center



switchboard

panelboard

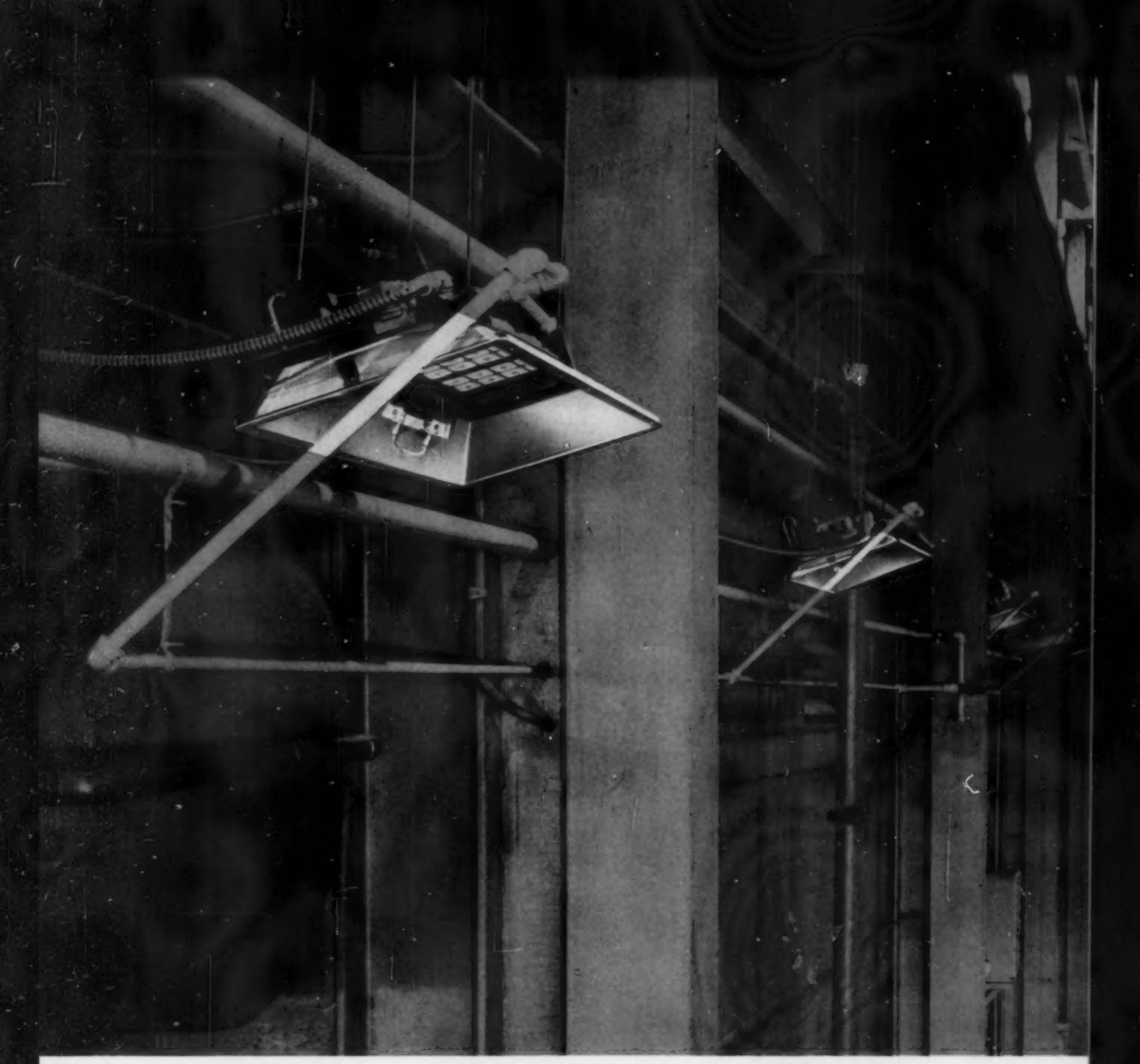
enclosed circuit breaker

New and exclusive from Federal Pacific—Rotary Handle circuit breakers—the simplest, safest molded case breakers in the industry. Here is the one sure way to eliminate troublesome mechanical linkages . . . to forget all external mechanisms . . . to be absolutely certain of positive operation and true handle indication. Integral cylinder lock and locking ring for up to three padlocks are standard on all breakers. Federal Pacific breakers can be locked "on" or "off" independent of door position. Four frame sizes—15 to 800 amperes—meet all requirements for panelboards, switchboards, control centers and individually enclosed circuit breakers. Write for Bulletin 1425, Dept. FP-4, Federal Pacific Electric Company, Newark 1, New Jersey.

FEDERAL PACIFIC ELECTRIC COMPANY

FP⚡E

growth through creative energy

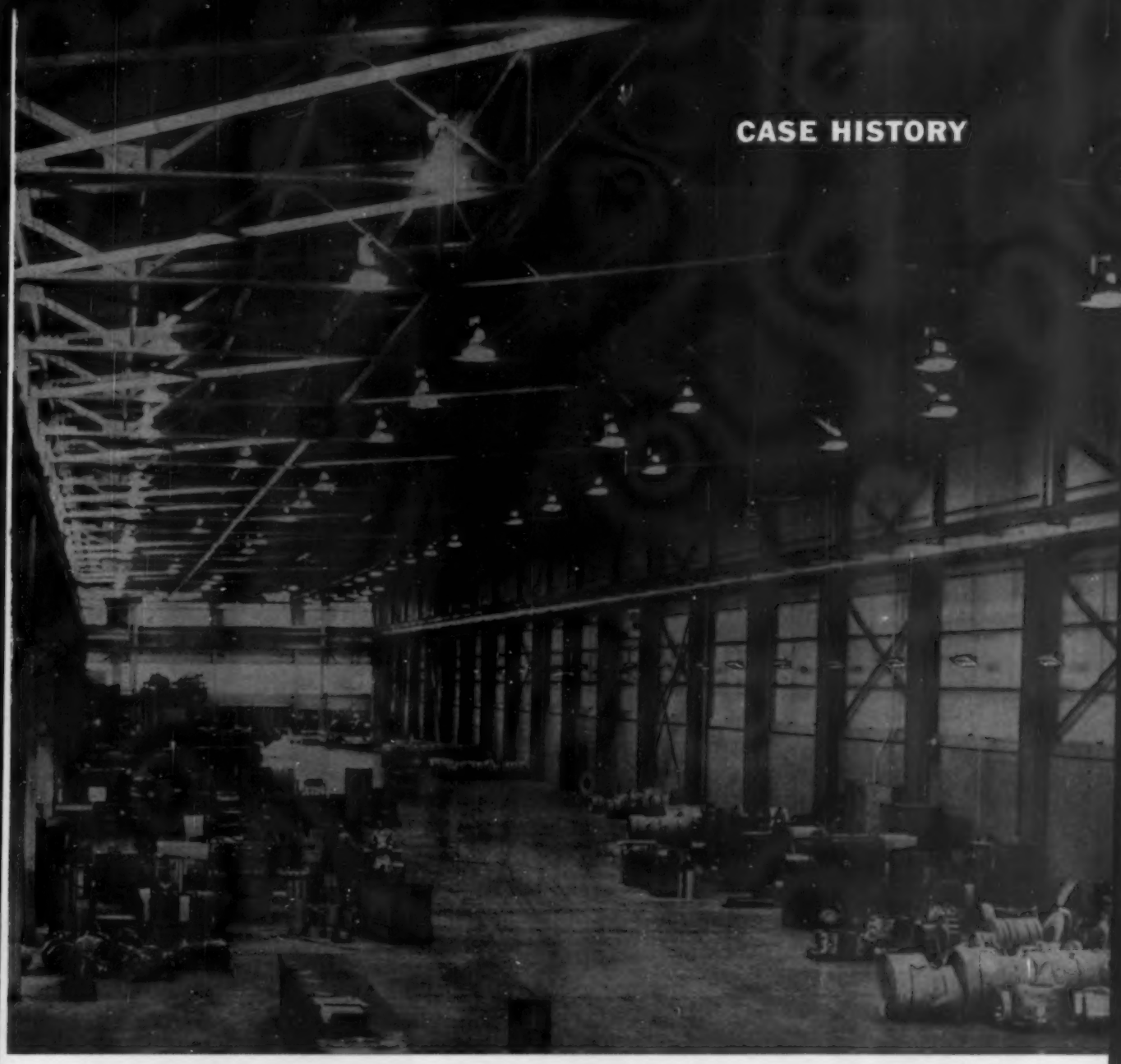


Universal-Cyclops equips new Coshocton plant with

PERFECTION SCHWANK Gas Infra-Red Heaters

Amazing Comfort Plus $3,470. Fuel Savings

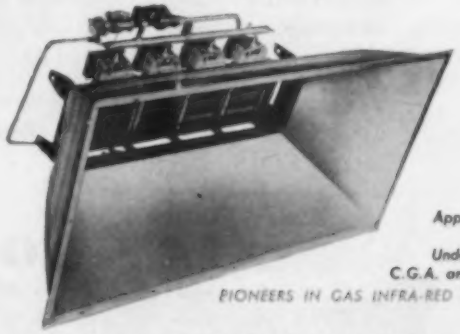
For more facts circle 536 on Reply Card



After an extensive investigation of all types and methods of space heating, Universal-Cyclops Steel Corporation chose Perfection Schwank Gas Infra-Red Heaters as the best available method of heating their new ultra modern stainless strip steel plant at Coshocton, Ohio. They have installed Perfection Schwank Heaters exclusively except for office areas and use (352) 48,000 BTU units to maintain a constant temperature of 65°F. over a high bay floor area of 320,000 square feet. These units provide silent and trouble-free operation. In addition, the working conditions maintained by these heaters, uniform temperature, warm floors and machinery, and cleanliness are a boom to production and a great asset in the close tolerance, fine finish operation to produce Universal-Cyclops high quality stainless steel.

Satisfaction such as this is standard among the more than 25,000 enthusiastic users of Perfection Schwank Gas Infra-Red Heaters. Call, write or wire for complete information.

80′ Wide, 785′ long, 52′ high main bay of Universal-Cyclops Coshocton Plant. The entire plant (exclusive of office space) is heated by Perfection Schwank Gas Infra-Red Heaters; has concrete floors, insulated steel roof and non-insulated walls.



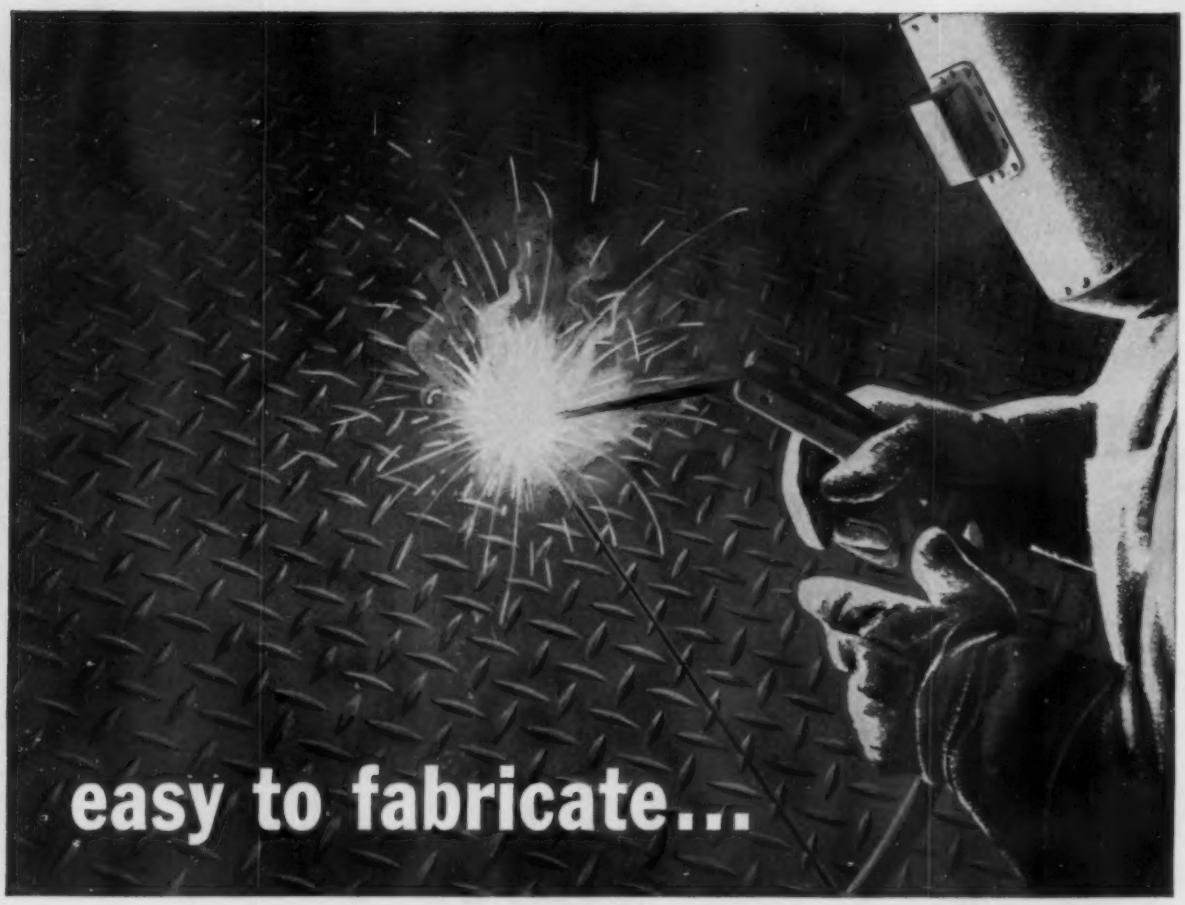
Approved by A.G.A., Underwriters, C.G.A. and C.S.A.

PIONEERS IN GAS INFRA-RED HEATERS

Under Schwank U.S. Patents 2,775,294 and 2,870,830 and pending applications.

PERFECTION 1135 Ivanhoe Rd., Cleveland 10, Ohio

division of **Hupp Corporation** / licensee of **American Infra-Red Radiant Co.**



Alan Wood Super Diamond floor plate is readily welded

Here's a rugged, heavy-duty floor plate that can be easily and quickly welded with ordinary equipment. It can be fabricated and easily matched . . . will wear indefinitely. The unique arrangement of the pattern allows you to bend or cut A. W. Super Diamond any place.

Super Diamond has many benefits: available nationwide from warehouses . . . easily swept, hosed or mopped, from any direction, with no pockets to hold dirt . . . safe, non-skid footing.

For easy fabrication . . . for long wear . . . for easy installation . . . specify Alan Wood Super Diamond. Write for Bulletin SD-S3.

ALAN WOOD STEEL COMPANY

Conshohocken, Pa. • STEEL PRODUCERS WITH THE CUSTOMER IN MIND

DISTRICT OFFICES AND REPRESENTATIVES: Philadelphia • New York • Los Angeles • Boston • Atlanta Cincinnati • Cleveland • Detroit • Houston • Pittsburgh • Richmond • St. Paul • San Francisco • Seattle Montreal, Toronto and Vancouver, Canada—A. C. Leslie & Co., Ltd.

For more facts circle 537 on Reply Card

16,000 engineers can't be wrong!

Over the last 50 years, engineers of more than 16,000 steam plants have specified and used Yarway Seatless Blow-Off Valves.

Why?

They know that . .

Savings in maintenance costs . . .
Freedom from boiler outages . . .

have repaid over and over again the cost of Yarways!

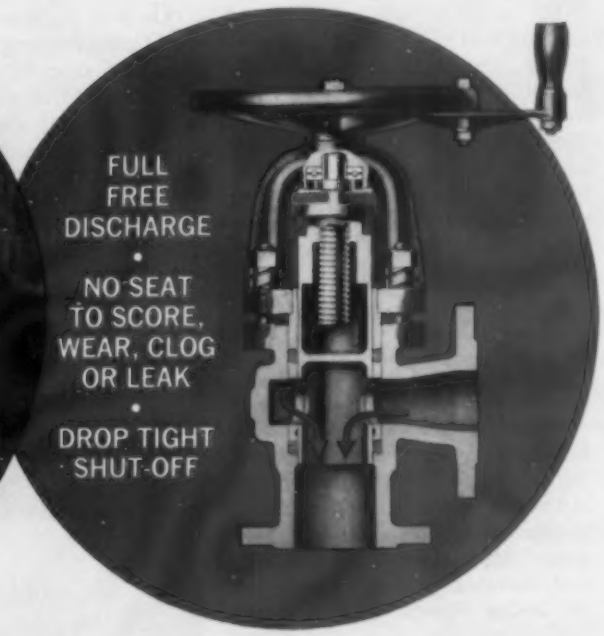
How?

Exclusive Yarway "Seatless" valve design means . . . NO SEAT TO SCORE, WEAR, CLOG OR LEAK!

If you are planning purchase of a new boiler, or modernization of present boilers, *insist on protecting your investment with Yarway blow-off valves.*

Write for Yarway Bulletin B-427.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES



Typical installation of Yarway Seatless Blow-Off Valves

A FEW OF MANY BOILER MANUFACTURERS STANDARDIZING ON QUALITY YARWAY BLOW-OFF VALVES

BROS INCORPORATED
CLEAVER-BROOKS CO.
DIXON BOILER WORKS
ERIE CITY IRON WORKS
E. KEELER COMPANY
SPRINGFIELD BOILER
STRUTHERS-WELLS CORP.
THE TITUSVILLE IRON WORKS CO.
HENRY VOGT MACHINE CO., INC.
THE WICKES CORPORATION

YARWAY
A MARK OF QUALITY IN STEAM ENGINEERING

For more facts circle 538 on Reply Card

OPERATION AND PRODUCTION® —pointers for the industrial plant engineer

Edited by Vern Kempf

Long Low Building Provides Uninterrupted, Weatherproof Run for Cable Sheathing Operation

Long building protects cables during sheathing operation. Completed cables are wound on reels in building at left.

Interior of tunnel-like steel building, 1100 ft long, showing cable being prepared for pull into sheathing laid on floor.

TO PROVIDE an uninterrupted weatherproof run for applying aluminum sheath to electrical cable assemblies, the Okonite Company, a subsidiary of Kennecott Copper Corporation, erected a steel building with unusual proportions. The building is approximately six feet wide, eight feet high but stretches 1100 ft from one end to the other.

The long building permits decoiling of complete lengths of aluminum sheathing to insert the cable cores.

At one end of the long building, a slightly larger single-slope structure houses the let-off equipment for the cable sheathing operation. At the other end, a gable-roof steel building, 50 by 100 ft, houses the take-up machinery for rewinding.

Although originally used for experimental projects involving defense applications of the air-dielectric cables, various types of electrical power and control cables of more standard designs have been sheathed in this operation. All three steel buildings were furnished by Armco Drainage and Metal Products, Inc.

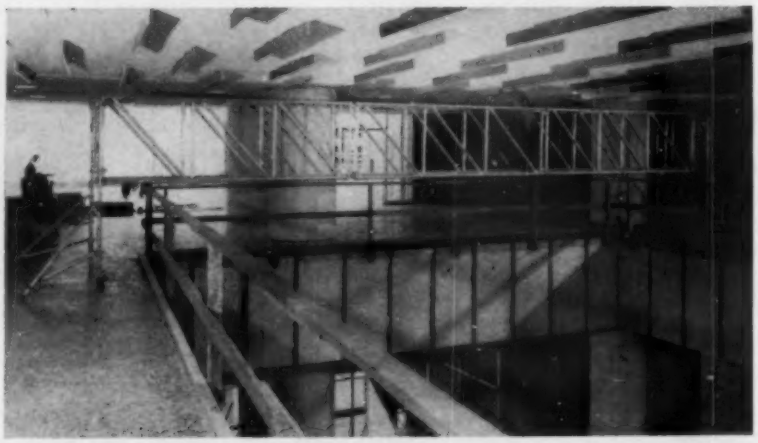
Bridge Scaffold Speeds Lighting Installation, Solves Relamping Problem Over Escalator Well

SOLUTION to the problem of installing and maintaining a luminous ceiling over a 27-ft escalator well at the new Kaiser Center, Oakland, California, was provided by a 36-ft span folding truss aluminum scaffold. Erected in just 10 minutes, the bridge eliminates the time-consuming erection of a complicated rig of ladders based around the escalator at the floor of the well.

With supporting end frames on wheels, the scaffold is an assembly of three 12-ft folding sections forming two vertical trusses.

Purchased by Kaiser engineers for routine lamp replacement, the aluminum scaffold was manufac-

(Continued on page 60)



Aluminum bridge type truss scaffold structure, 36 ft wide, spans open escalator well to speed installation and permit routine maintenance of luminous ceiling.

SILICONE NEWS from Dow Corning

Now I'm In Little League

Since We've Converted "Down-time" to "Spare-time" by Specifying Silicones

Three years ago, when Little League baseball was organized in our community, I was interested. Because I'm a family man with three boys, and I'd been a fair ball player, I was asked to manage a team. I wanted to help, but with my job, I knew I wouldn't have the time.

You see, I'm maintenance manager at the local foundry and metal working plant. We have more than 1500 integral horsepower motors. When a motor burns out, it has to be replaced immediately. With the increased frequency of failure in the summer . . . plant temperatures skyrocket . . . my time is not my own.

One day I saw a Dow Corning advertisement about silicone insulated motors. I wrote them and got all the information . . . technical data, too. After studying the material, I suggested to management we run our own life tests by having our problem motors rewound with silicones instead of with Class B insulation, as we were doing.

Result: we now specify silicone insulation in all of our motors exposed to heavy duty cycles, shock loads, frequent start-stop-reverse operation, high ambient temperatures and humidity. Savings are around $5000 a year . . . *not counting the savings in production and maintenance time.*

The sharp reduction in motor maintenance has given me some free time. This summer I managed a Little League team. By the way, my oldest boy looks great at second base, and he's no slouch at the plate.

Say, why don't you write Dow Corning for their literature on silicone insulated motors and transformers? I'm glad I did.

(This fictional story is based on actual plant experience with silicone insulation. Name provided on request.)

For information on silicone insulated motors, write Dept. 3210

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

For more facts circle 539 on Reply Card

OPERATION — PRODUCTION

(O and P begins on page 58)

tured by Up-Right Scaffolds, Berkeley, California. When not in use, the bridge folds down to a compact assembly and is transported 400 ft by hand truck to a storage area.

Scooters Move Guards Faster

KEEPING an hourly security patrol of its 6,000,000 sq ft plant in East Pittsburgh, Pa., was becoming a troublesome and costly problem for Westinghouse Electric Corp. The hourly patrol was required in all idle sections whenever a shift was changed. Also it was necessary to have a large security force when the plant was idle on Saturdays, Sundays and holidays.

To solve this problem, Westinghouse requested permission from its insurance underwriter to give the guards some means of transportation to assist them in covering their assigned territories. After the insurance underwriter agreed to this, the company investigated the many different types of vehicles available.

Electric truck with average speed of eight mph enables guard to cover three times as much area as he could on foot.

One-passenger electric trucks manufactured by Cushman Motors, Lincoln, Nebraska, were selected by the company. Westinghouse now has 10 of these units at a total cost of less than $11,000. This price included modifications to the frames to allow them to carry a heavier than standard battery and facilities for recharging.

Plant Engineer C. J. Zetler, Jr. said, "We have used the one-passenger electric Cushman Trucksters for four years now and have had no problems with them whatsoever. Our maintenance costs with these vehicles have been surprisingly low." Average speed of the trucks is eight mph which enables a guard to cover three times as much area as he could on foot.

Bins Slash Handling Costs

INSTALLATION of bulk material handling containers is saving the Nestle Company over two mandays per shift at its Marysville, Ohio plant. The installation, engineered and fabricated by Tote System Inc., of Beatrice, Nebraska, is also saving half of the warehouse space formerly required for storing milk powder products.

Prior to installing the 120 bins, Nestle was storing the dried milk powders in two large stainless steel tanks and a number of steel barrels. To dump the barrels into processing required an absolute minimum of three men. Increases in production necessarily meant commensurate increases in manual labor.

With the Tote System, one man handles the entire job and also

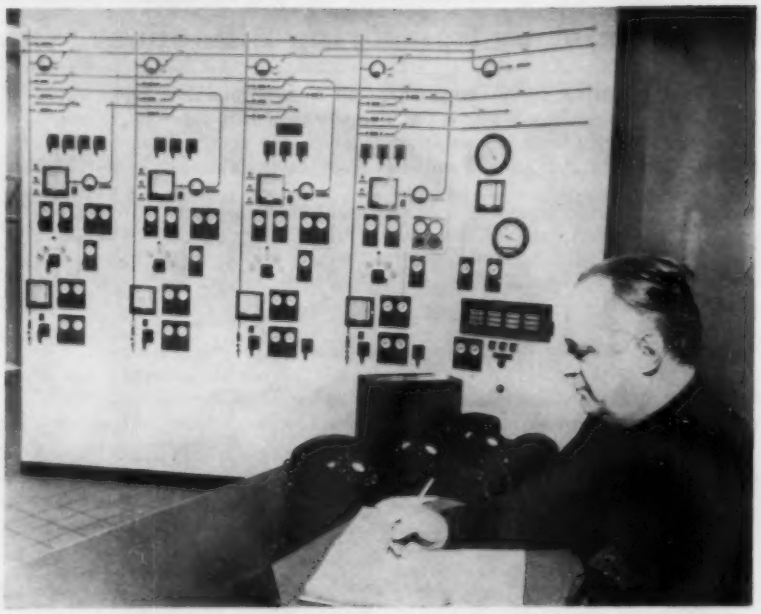
(Continued on page 62)

Various Control Setups Permit Flexibility In Operating Split-Wind Blowing System

STEEL MILL engineers have found many opportunities for more efficient use of modern high-capacity turbo-blowers by combining them in split-wind blowing systems. This is a system where one or more blowers supply blast air to two or more blast furnaces.

A split-wind system, controlled from a graphic panel, is providing this high-efficiency, money saving operation at the Gary Works of the U. S. Steel Corporation. From this panel, operators have centralized control of four blowers that can provide blast air to four furnaces.

Designed and manufactured by Hagan Chemicals & Controls, Inc., the control system normally operates with three blowers blowing four furnaces with one turbo unit on standby. The great amount of flexibility possible through various control setups allows operators to achieve high blowing economies.



Graphic control panel centralizes complex split-wind blowing control involving distribution of blast air from four modern turbo-blowers to four blast furnaces.

MOTORS

1 thru 200 horsepower

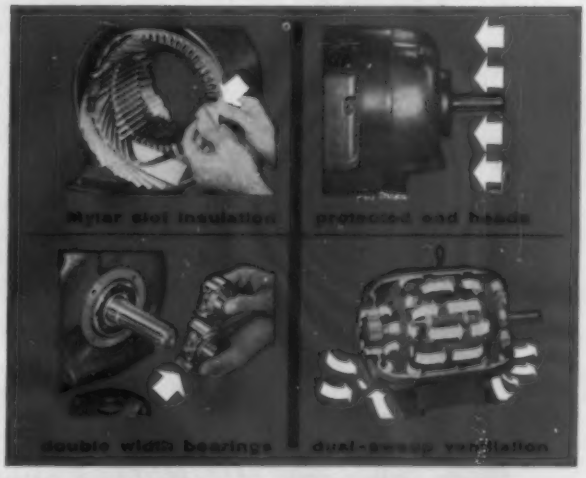
(other ratings 1/200 to 1 h.p.)

"On-the-Job" Bearing Inspection and Relubrication are Easy!

ROBBINS & MYERS motor bearings are fully sealed and pre-lubricated to operate for years without attention of any kind. However, when maintenance schedules call for bearing inspection and relubrication at shorter intervals, R&M motors cut downtime and save labor expense by making these inspections easy. The bearing cap on each end head comes off quickly when the four securing bolts are removed. The bearing seal, held in place by removable snap rings, likewise, is easily removed to expose the interior of the bearing.

Easily removable bearing caps are only one of R&M's many desirable design features. Double width bearing races have extra-large grease capacity . . . Mylar* insulation that has 8 times the dielectric strength and 35 times more moisture resistance than ordinary paper insulation . . . end heads offer full-height protection . . . dual-sweep ventilation assures efficient cooling. For details, write today for Bulletin 520 PE

**DuPont registered trademark*



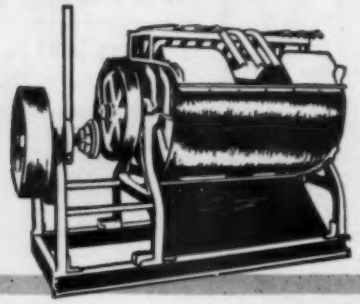
ROBBINS & MYERS, INC.

motors, household fans, Propellair industrial fans, hoists, Moyno industrial pumps

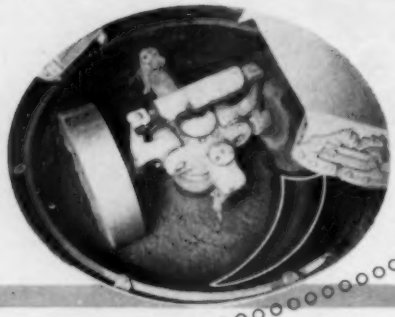
SPRINGFIELD, OHIO · BRANTFORD, ONTARIO

For more facts circle 540 on Reply Card

You can MIX without a muller;



but can you MULL without mullers?



A study in semantics . . .

The muller is a very specialized piece of mixing equipment. It is specifically designed for use where an intensive, intimate blend of dry/solid, solid/solid or wetted/solid materials is needed. Equipment designed for mulling is manufactured under the trade names: CLEARFIELD, LANCASTER, SIMPSON MIX-MULLER and others. As a class, they are mixers. As a family, they are mullers. They are akin because they are all equipped with MULLER WHEELS.

Trying to mull, or achieve controlled dispersion, in a machine not equipped with MULLER WHEELS is like flying a tailless kite on a windy day . . . you may get it off the ground, but you have no *control*.

The fact that you can *control* dispersion through the use of muller wheels is the reason why at least three manufacturers have specialized in this art for about half a century. Today, the need for *controlled dispersion* has become increasingly evident to processors as well as to mixer manufacturers . . . *everybody's* got a muller. So, if you need controlled dispersion, it will pay you to remember that *mulling* is more than a matter of semantics. What was a *mixer* last year . . . is not necessarily a *muller* this year.

Simpson Mix-Muller Division has devoted a 12-page bulletin to the subject. It's called the HANDBOOK ON MULLING. Why not write for a copy? Or, see it in the current *Chemical Engineering Catalog.*

Presented in the interests of maintaining truthful presentation of-and purposeful application for, the mulling *principle of mixing by:*

SIMPSON *MIX-MULLER*® DIVISION
NATIONAL ENGINEERING COMPANY
604 Machinery Hall Bldg., Chicago, Illinois

P1300

For more facts circle 541 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 58)

Discharge stations convert bins into self-dumping hoppers to gravity feed packaging line located on floor below.

takes care of supplemental sanitation work in the area. Since the bins are resealed immediately after being emptied, it is not necessary to clean the containers after each use.

Corn Cob Blasting Cuts Cleaning Time

SOFT ABRASIVE blast cleaning has proved the best degreasing system available for the kind of work performed at the Elliott Company, Division of Carrier Corp., Jeannette, Pa. The Elliott Company manufactures steam turbines, condensers, steam jet ejectors, strainers, turbochargers and centrifugal compressors.

Degreasing turbocharger rotor as-

Ground corn cobs, propelled by compressed air, provide a cleaning action which rapidly removes grease and dirt.

Get 31% more filming action with Dearborn's Super Filmeen®

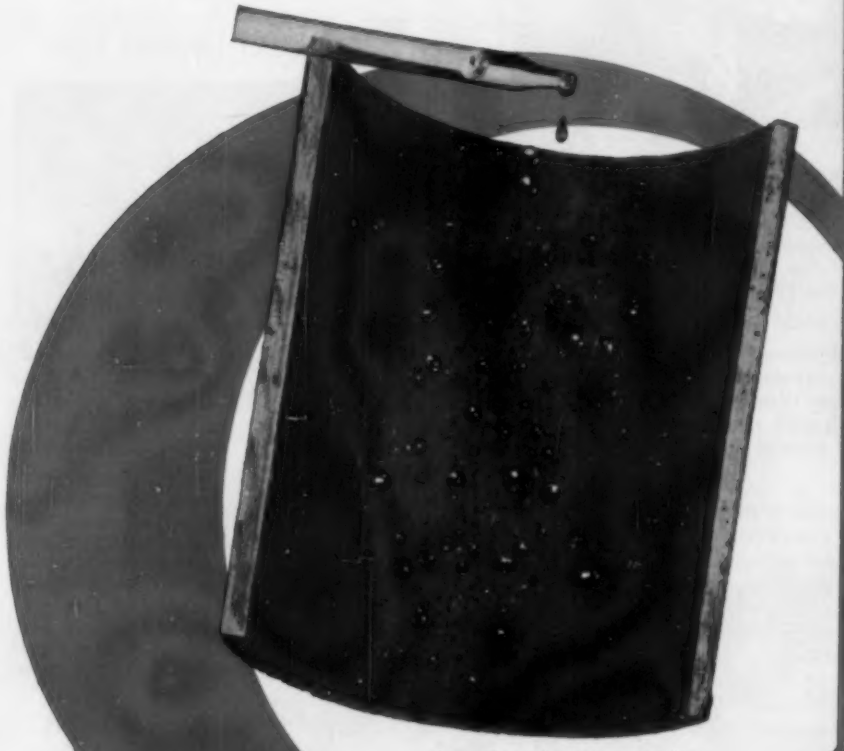
In either flake or emulsion form, Super Filmeen—a development of Dearborn's research laboratories—has been proved 31% more active than ordinary octadeclyamine acetate . . . is not subject to dehydration at super-heated steam temperatures . . . will not hydrolyze to acetic acid . . . remains alkaline in feed solutions.

Prevents corrosion due to carbon dioxide or oxygen . . . effective when fed to boilers, feed or steam lines . . . removes deposits and corrosion products from heating surfaces and return lines . . . compatible with most treatment chemicals.

Update *your* condensate system protection with Super Filmeen. Call your Dearborn engineer or write for detailed Technical Bulletin today!

DEARBORN CHEMICAL COMPANY

General Offices: Merchandise Mart, Chicago 54 · Dallas · Des Plaines, Ill. · Ft. Wayne · Honolulu Linden, N. J. · Los Angeles · Nashville · Omaha · Pittsburgh · Toronto · Havana · Buenos Aires

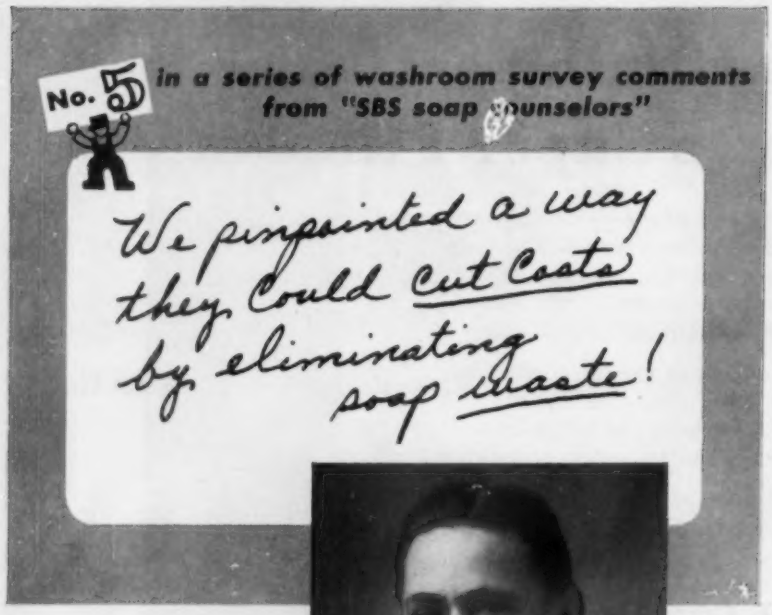


Super Filmeen forms a non-wettable, monomolecular, corrosion inhibiting film. Note how water remains in droplets which roll off a Super Filmeen treated pipe surface.

pioneer in the science of corrosion control

dearborn

For more facts circle 542 on Reply Card



Robert Foss,
veteran SBS soap counselor in the Wisconsin-Minnesota area, has helped scores of plants find economical solutions to their wash-up and hygiene problems. Here's his report on a metalworking plant employing better than 3800 workers:

"We found this plant's washroom costs way up! The powdered and liquid soaps provided in the washrooms were being wasted by the handfuls. Result: unsightly washbasins, slippery floors, excessive soap and housekeeping costs. In addition, these soaps proved only partially effective against the more irritating, difficult-to-remove soils in the plant.

We showed them how much more *effectively and economically* SBS 60 can do the job. Formulated especially for industrial use, this quick-acting *cream* deodorant soap is virtually impossible to waste . . . is equally safe on face, hands or body . . . and removes *all* the general soils found in this plant."

Money-saving suggestions like this *begin* with OPERATION PINPOINT–a thought-provoking presentation filled with facts about skin hygiene and washroom maintenance. The SBS soap counselor serving your area can pinpoint the right soap to do every skin cleansing job best and at lowest cost in your plant. Let him show you OPERATION PINPOINT . . . just call your nearest SBS office, collect.

the washword of industry

SBS sugar beet products co.

SAGINAW, MICH. • Los Angeles, Calif. • Newark, N.J.
CANADA: Chemical By-Products, Ltd., Toronto, Ontario

For more facts circle 543 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 58)

semblies is one problem made special by the fact that it involves steel bushings set in aluminum. Electrolysis causes trouble when attempts are made to clean these with conventional liquid solvent methods. An effective and economical solution to this problem was found in the soft abrasive degreasing system developed by Pangborn Corporation, Hagerstown, Md.

With this method the soft abrasive, ground corn cobs, is propelled by compressed air, providing both a blasting and wiping action which removes grease, dirt and oily residue rapidly and effectively. Work is accomplished in a sheet metal blast compartment, served by a Pangborn dust collector, to confine the blast action and prevent spread of the abrasive to adjacent areas.

Tongs Lift 37-Ton Covers Safely

Bell covers, 20 ft high, weighing 74,000 lb are lifted quickly and safely with four-legged automatic tongs at Midvale-Heppenstall Company, Philadelphia. Covers are part of vacuum stream degassing system installed in plant's steel melting department. Tongs, manufactured by Materials Handling Division of Heppenstall Co., are designed to fit a collar welded to bell cover.

Magnetic Belt Cures Press Jams

INSTALLATION of magnetic conveyors at Ford Motor Company's Sharonville Plant, Cincinnati, Ohio, has solved the problem of establishing dependable control of parts as they are taken from presses by conveyors.

In this automatic operation, strip

Super COILIFE*, the new epoxy encapsulation, gives your rewound motors extra operating life . . . and is completely compatible with Guardistor* winding protection. It thoroughly protects against acids, alkalis, moisture, oil, dirt and other contaminants. Super Coilife has proved itself in thousands of applications in mines, chemical plants, petroleum refineries, and other industries. With extraordinarily low viscosity, this encapsulation permeates slots and interstices, thoroughly protecting windings inside and out.

*Trade-Marks

new!! foolproof overtemperature protection for rewound motors

Now, for motors being rewound, Westinghouse offers P.T.C. thermistors—the new Positive Temperature Coefficient semiconductor—to rebuild your conventional motor into a Guardistor motor. Guardistor motors prevent overheating—the major cause of motor failure. This positive protection is available for any make or type of a-c squirrel-cage motor, including multispeed, and for any class of insulation including motors encapsulated with exclusive Super Coilife epoxy.

The heart of the Guardistor motor is the P.T.C. thermistor, one per phase, completely embedded in the motor windings. This inherent protection will provide a warning, will take the motor off the line, or do both. Since the thermistor is temperature sensitive only, it reflects the total winding temperature resulting from all heat sources. It is available for various classes of insulation, at appropriate tripping temperatures, insuring full insulation protection plus full motor capability without nuisance tripping. Westinghouse rewinding with exclusive Guardistor protection is fully guaranteed.

Call your Westinghouse representative for more information on Super Coilife insulation and Guardistor protection on your next motor rewind. You can be sure . . . if it's Westinghouse. J-95218

Westinghouse

For more facts circle 544 on Reply Card

NEW MIXER

Get set to topple some traditions in fluid-mixing ease and economy

You won't have to lubricate it for five years.

You can't overload the gear drive.

It comes with a chemical plant motor as *standard*, at no extra cost.

You don't need three hands to remove the shaft.

And it mixes fluids like no portable mixer you've ever seen. Delivers up to 45% more fluid flow in gear-drive models. Higher impeller head in direct-drive models. Actually lets you handle many mixing jobs with a *smaller* mixer drawing *less power.*

That's just a sampling of the new LIGHTNIN Portable Mixer. It's ready —in sizes from ⅛ to 3 hp. And the price is right.

Your LIGHTNIN Mixer representative will be glad to show you why you can use it to mix fluids better—and at lower cost—than ever before. You'll find him listed in Thomas' Register of American Manufacturers and in the yellow pages of your telephone directory. Call him today. Or write us for descriptive Bulletin B-520.

SHOCK OVERLOADS can't damage the mixer drive. In gear-drive models, GripSpring assembly between gear and drive shaft lets gear slip if overloaded more than 50%. It's a safety feature you never could get before in a portable mixer.

IN FIXED MOUNTINGS, TOO. Get the same all-new advantages in permanent-mounting LIGHTNIN Mixers for open and closed tanks. A complete line, sized from ¼ to 3 hp. For details on these, send for Bulletin B-521.

Lightnin' Mixers

MIXCO fluid mixing specialists

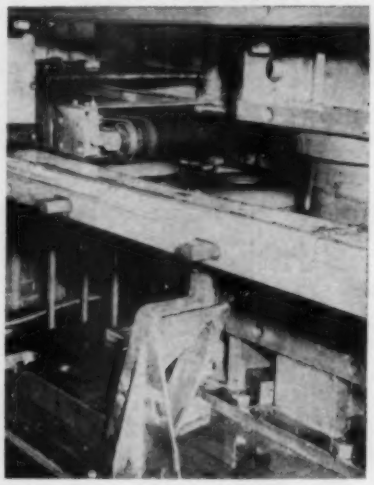
MIXING EQUIPMENT Co., Inc., 144-K Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

For more facts circle 545 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 58)



Steel blank is attracted to under side of belt and moved out of press bed.

steel is fed into a 1000-ton, six-position, progressive die press which forms it into impeller shells. As the stampings move from the dies they are picked up by a magnetic conveyor and moved to the discharge point. Magnetic units, installed just above the under surface of the moving belt, maintain a powerful magnetic field which picks up the stampings as fast as they come into range.

Parts are automatically released at the end of the conveyor and with a change in direction, move to the upper surface of a similarly magnetized conveyor. Here they are held in fixed positions as they move down a steep incline to other operations. Conveying parts at the rate of 28 per minute, the new system has eliminated the frequent pile-ups that formerly interfered with production.

Magnets used were furnished by the Eriez Manufacturing Company and consist of permanently magnetized rails designed for easy assembly to new or existing conveyor systems.

Carrier Saves Five Trips

DRUM HANDLING has been simplified at Standard Oil of Ohio Company's Refinery in Cleveland through the use of a straddle carrier equipped with extra long load hooks. Drums are filled with oil products at an average rate of one

JENKINS PRACTICAL PIPING LAYOUT 83

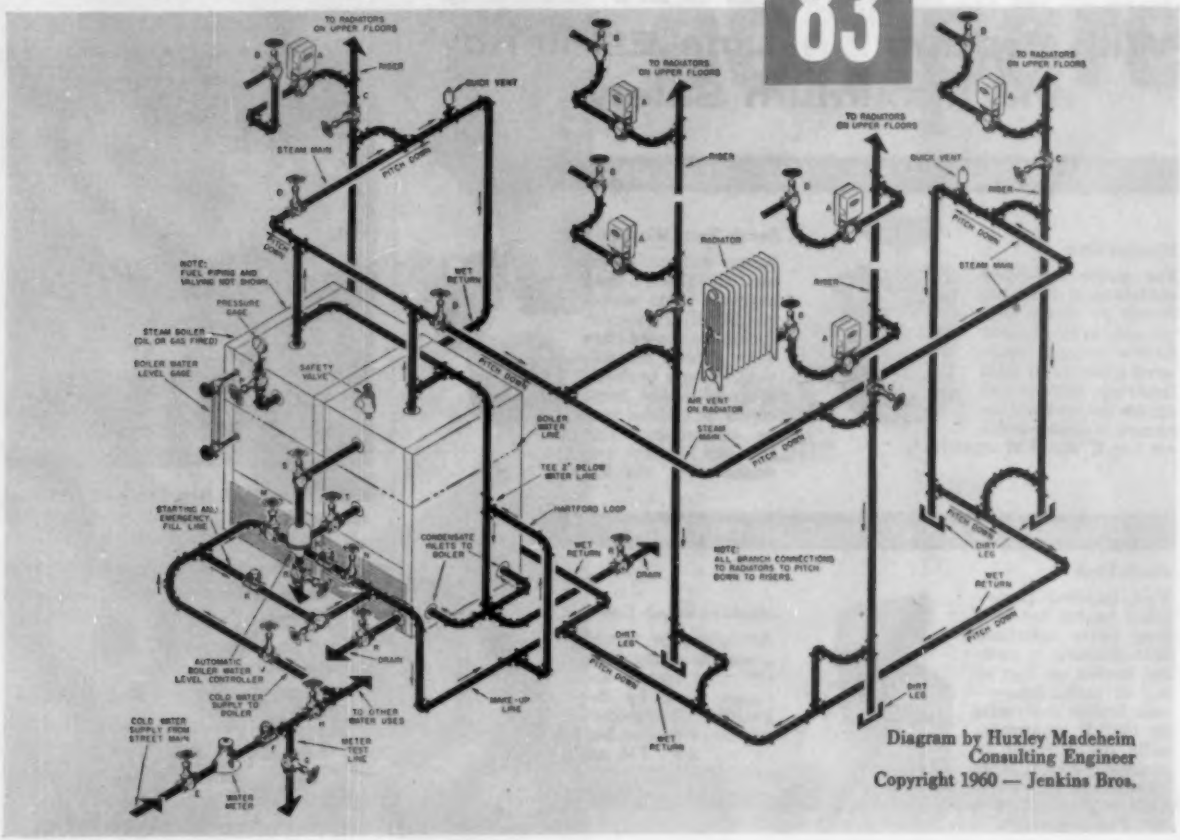


Diagram by Huxley Madeheim
Consulting Engineer
Copyright 1960 — Jenkins Bros.

ONE-PIPE HEATING SYSTEM WITH INDIVIDUAL THERMOSTATIC CONTROL OF EACH AREA

Because of low installation, operation and maintenance costs, this one-pipe system is popular for multi-story buildings where radiators are placed one above the other in line on various floors. It requires no traps, pumps, expansion or balance tanks or special fittings, and its simplicity avoids danger of freeze-up or water leaks. Thermostatic control of the fuel burner and elimination of dependence upon manually-controlled radiators remove principal objections to the conventional one-pipe system . . . the time delay in starting from a cold boiler, uneven heating due to this delay, and insufficient pressure to assure steam in furthermost radiators.

The burner in the boiler of this system operates responsive to an outdoor thermostat which starts or cuts off the burner whenever outside temperature changes from a predetermined value. The burner is also controlled by a pressurestat which cuts off burner at a predetermined value such as 8 psi, and starts it at a lower limit such as 4 psi. The burner can also be controlled by a program clock.

Each individual radiator or area is controlled by a motor operated globe valve of the type made by New England Gear Works, Southington, Connecticut. Each of the valves opens or closes responsive to a thermostat located in the area served by the radiator. The combination of outdoor and area thermostats assures steam in the system and even heat at all times in all areas. A manually-operated radiator angle valve permits shut-off of each radiator whenever desired. A gate valve at bottom of each riser allows access to motor operated valves on that line.

Conventional steam boiler piping and controls are used, with an automatic boiler water level controller, fitted with a manually operated by-pass.

Jenkins Fig. 47-U Standard Bronze Gate Valve, in this layout has design features which assure excellent performance in steam heating service. A solid bronze wedge affords maximum resistance to pressure strains of rapidly vibrating steam. A rising spindle and wheel indicates wedge position, and the backseating bevel on shoulder of spindle permits the valve to be repacked under pressure when wide open.

To assure efficiency in the job when planning any major piping installation, consult with accredited piping engineers and contractors, and select your valves from the Jenkins Catalog.

Enlarged diagram and full description of this layout No. 83 free on request to Jenkins Bros., 100 Park Avenue, New York 17.

CODE	QUAN.	VALVES RECOMMENDED	SERVICE
A	6	Motor Operated Globe made by New England Gear Works	Automatic Steam Control
B	6*	Fig. 106, Bronze Radiator Angle	Manual Control Steam to Radiators
C	6**	Fig. 47-U, Bronze Gate	Individual Riser Shutoff
D	2	Fig. 47-U, Bronze Gate	Boiler Mains Shutoff
E	1	Fig. 47-U, Bronze Gate	City Water Supply Shutoff
F	1	Fig. 92-A, Bronze Swing Check	Prevent Backflow into City Water Main
G	1	Fig. 106-A, Bronze Globe	Meter Test Flow Control
H	1	Fig. 47-U, Bronze Gate	Building from Meter Shutoff
J	1	Fig. 47-U, Bronze Gate	City Water Make-up to Boiler Shutoff
K	2	Fig. 92-A, Bronze Check	Prevent Backflow from Boiler to City Water
L	1	Fig. 108-A, Bronze Angle	Manual Control Water to Boiler
M	1	Fig. 106-A, Bronze Globe	Control Automatic Boiler Water Level Controller
N	1	Fig. 47-U, Bronze Gate	Shutoff Automatic Boiler Water Level Controller
P	1	Fig. 743-G, Bronze Needle	Steam to Pressure Gage Control
R	3	Fig. 108-A, Bronze Angle	Control Drainage from Boiler and Equipment
S	1	Fig. 108-A, Bronze Angle	Shutoff Automatic Boiler Water Level Controller from Boiler
T	1	Fig. 106-A, Bronze Globe	Shutoff Automatic Boiler Water Level Controller from Boiler

*One for each Radiator **One for each Riser

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros

Sold Through Leading Distributors Everywhere

For more facts circle 546 on Reply Card

Here's How To Handle FLAMMABLE SOLVENTS With Production-Line Efficiency and Maximum Safety...

SWABBING & SMALL PARTS CLEANING

Plunger Can

For quick, one-hand moistening of swab, brush or cloth. Depressing spring loaded dasher pumps measured quantity of fluid into cup. Release and excess drains back into can. 5 sizes—dashers 1 to 7" dia. FM approval*.

Bench Parts Washer

Keeps workers hands out of solvent. Removable parts basket has handle. Depress spring mounted fire baffle dasher for solvent, release to drain. Without basket, large cloths or swabs may be saturated. 3 pint capacity. Basket and dasher—5⅝" dia. FM approval*.

WASHING & CLEANING OPERATIONS

Wash Tank

Two handled perforated basket for fast, easy parts agitation. Self-draining by resting basket on lugs at top of tank. Renewable fusible link melts at 160° F, automatically drops cover to snuff out fire. 4 sizes ranging from 8½"x 8½"x9¾" to 15"x15"x 15". FM approval*.

Machine Bench Can

Attaches to bench alongside of machine. Operator cleans and rinses parts by depressing fire protective metal dasher. Size 10" x 7" x 8". FM approval*.

Foot Treadle Dip Tank

Work-high dip tank with self-closing cover operated by foot treadle. Designed for washing large parts. Safety air check cushions accidental fall of cover. 24¾" long x 13" wide and 8¾" deep. FM approval*.

Air-Matic Parts Washer

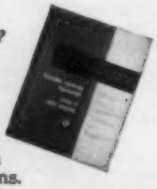
Air Motor moves basket thru solvent, automatically cleans parts while machine operator continues production. Fusible link drops cover automatically to snuff out fire. Operates on 25-50 p.s.i. air. Size 15"x15" x21". FM approval*.

Swab Can with Reservoir

For applications where large quantities of solvent are required. Supply tank mounted on common base with applicator can. Valve permits operator to replenish liquid supply at bench. Perforated metal fire baffle dasher. 2 sizes—1 gal. and 5 gal. capacity. FM approval*.

LOOKING FOR MONEY-SAVING IDEAS?

Protectoseal Catalog has many time and labor-saving suggestions for handling flammable solvents in production applications. Sent without obligation.



*Factory Mutual Laboratory approval

THE PROTECTOSEAL COMPANY

1944 South Western Avenue Chicago 8, Illinois

OPERATION—PRODUCTION

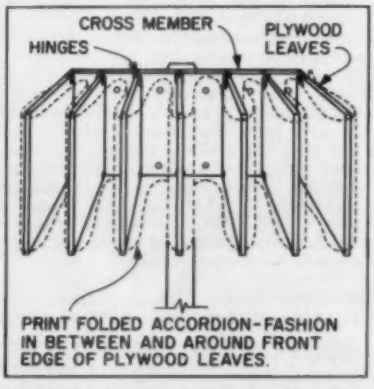
(O and P begins on page 58)

Extra long load hook on this straddle carrier picks up 24 full drums at a time.

per minute on an automatic filling line. Full drums are picked up, four at a time, by a fork truck and placed on pallets resting on a roller conveyor.

When six loaded pallets accumulate on the conveyor, a Clark-Ross straddle carrier, equipped with special lifting arms, moves over the load. Six pallets carrying 24 drums are picked up and delivered to a warehouse area several thousand yards from the filling line.

Blueprint Holder Saves Time



Designed by plant engineers at Douglas Aircraft Company, a holder for large blueprints is constructed like a huge book to permit more than one person to view different portions of the print at same time. Plywood leaves 40 in. high and 30 in. deep are held together by rear cross-members with each leaf hinged separately. Holder is held erect at correct viewing height by a wood upright anchored in concrete.

(O and P continued page 284)

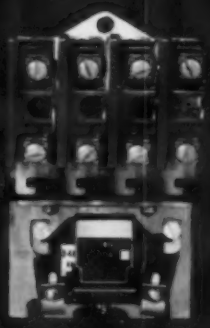
For more facts circle 547 on Reply Card

For more facts circle 548 on Reply Card——→

compare

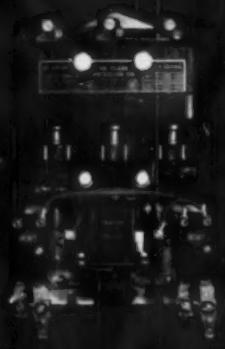
CLARK CONTROLS...

NEW Push Button Line



"PM" Relay Line...

with new "Color-Selective" Conversion Kits



Type "CY" Starters... the standard for longer operating life

SEE FOR YOURSELF WHY THEY GIVE YOU MORE THAN ANY CONTROLS YOU CAN NAME

The **CLARK CONTROLLER** *Company*

compare

see for yourself why...

NEW Clark Push Buttons with exclusive wipe action contacts give you more

WIPING CONTACTS—a Clark Controller exclusive—assures minimum contact resistance at all times. As contacts close, unique Clark design creates a sliding action that wipes faces clean of dust and oil.

DUAL COLOR-CODING—buttons and ferrules—in many separate colors, makes possible advantageous color-coding of stations both by individual operating function and group function.

THREE TYPES OF UNITS offer greater flexibility for any application:

- Type HO Oiltight—Panel or Base Mounted
- Type H NEMA I—Base Mounted
- Type H NEMA I—One Hole (Panel) Mounted

The new Clark Push Button line includes a complete range of buttons, selector switches, pilot lights and push-to-test lights or lighted push buttons—available as individual control units or mounted in enclosures or on flush plates.

compare

see for yourself why...

Clark Type "CY" Starters give you more than any other A-C magnetic starter

Whatever your basis for comparison let your own performance check show you how Clark Type "CY" Starters outperform all other starters—give you more.

DEPENDABILITY? Compare the Clark Type "CY" Starter in the toughest application you can find—then see for yourself how it continues to operate dependably where other starters fail.

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OTHER ADVANTAGES? Your own comparison tests on installation, maintenance, and any other requirements, will let you see for yourself that the Clark Type "CY" Starter gives you more than any other A-C magnetic starter in every area of importance.

Clark Type "CY" Starters are available in many combinations, in sizes 0 thru 4, and in a variety of enclosures and forms to meet every industrial application.

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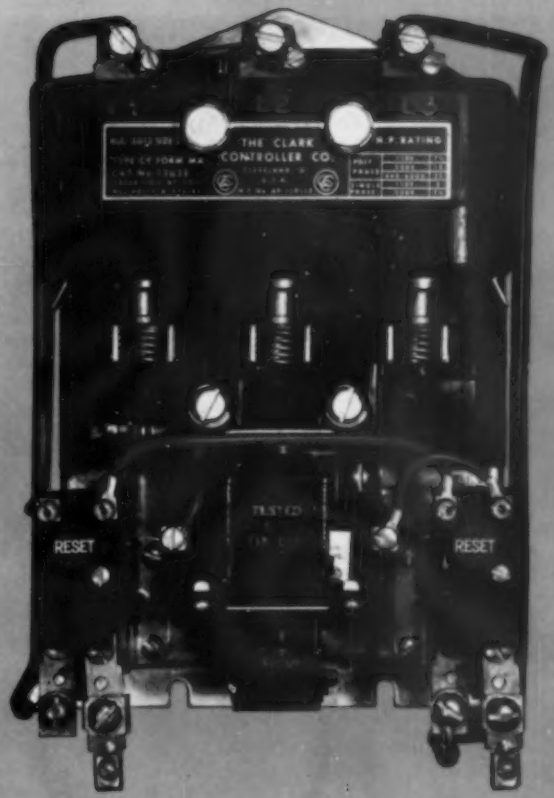

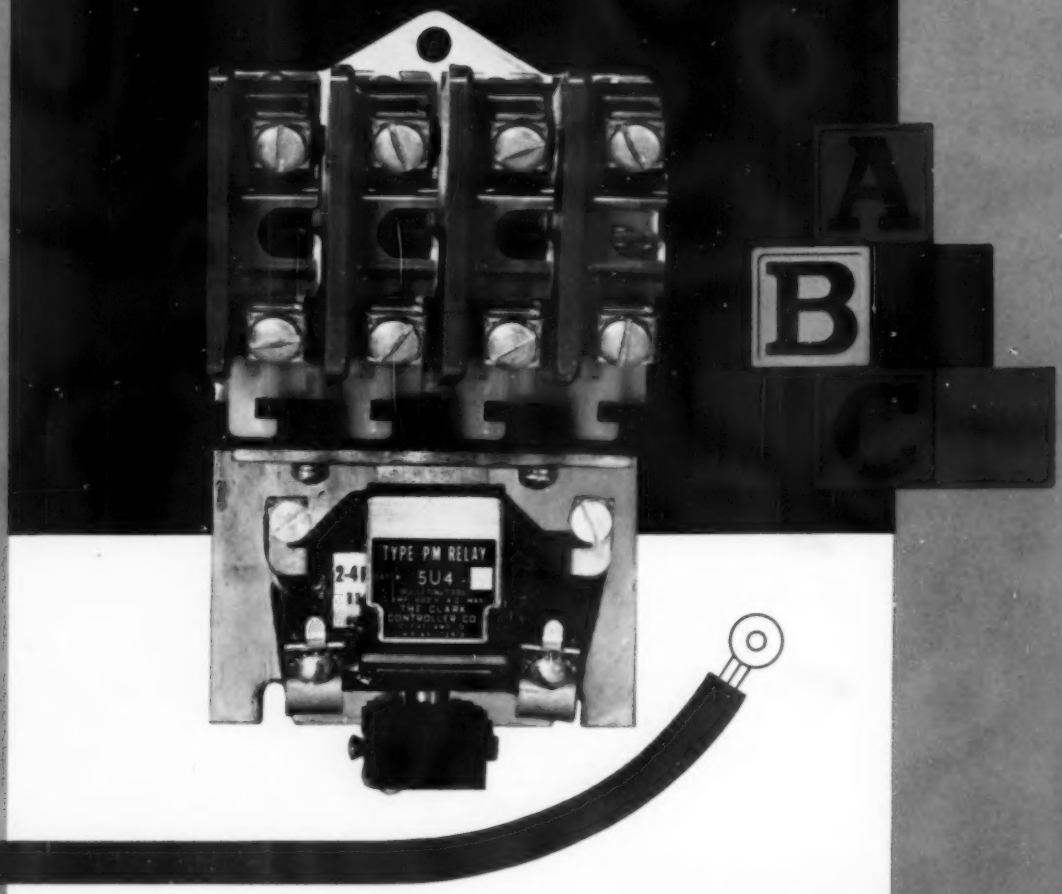

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New color-coding of conversion kits by function now makes it possible for relay users to take even greater advantage of the versatility and flexibility of the complete, integrated line of Clark "PM" Relays.

Basic relays are easily modified on the job with a few simple conversion kits to give you a virtually unlimited number of circuit arrangements on convertible pole, universal pole, latch and time-delay relays.

The "modular construction" of all relays in the Clark "PM" line insures integrated uniformity, compactness and flexibility. Functional alignment in mounting results in neater, more uniform panels and most efficient utilization of valuable space.

More for your money with

CLARK RELAYS

COMPLETE INFORMATION on Clark color-selective conversion kits is available through your local Clark distributor or district sales representative. Or, write direct to The Clark Controller Company.

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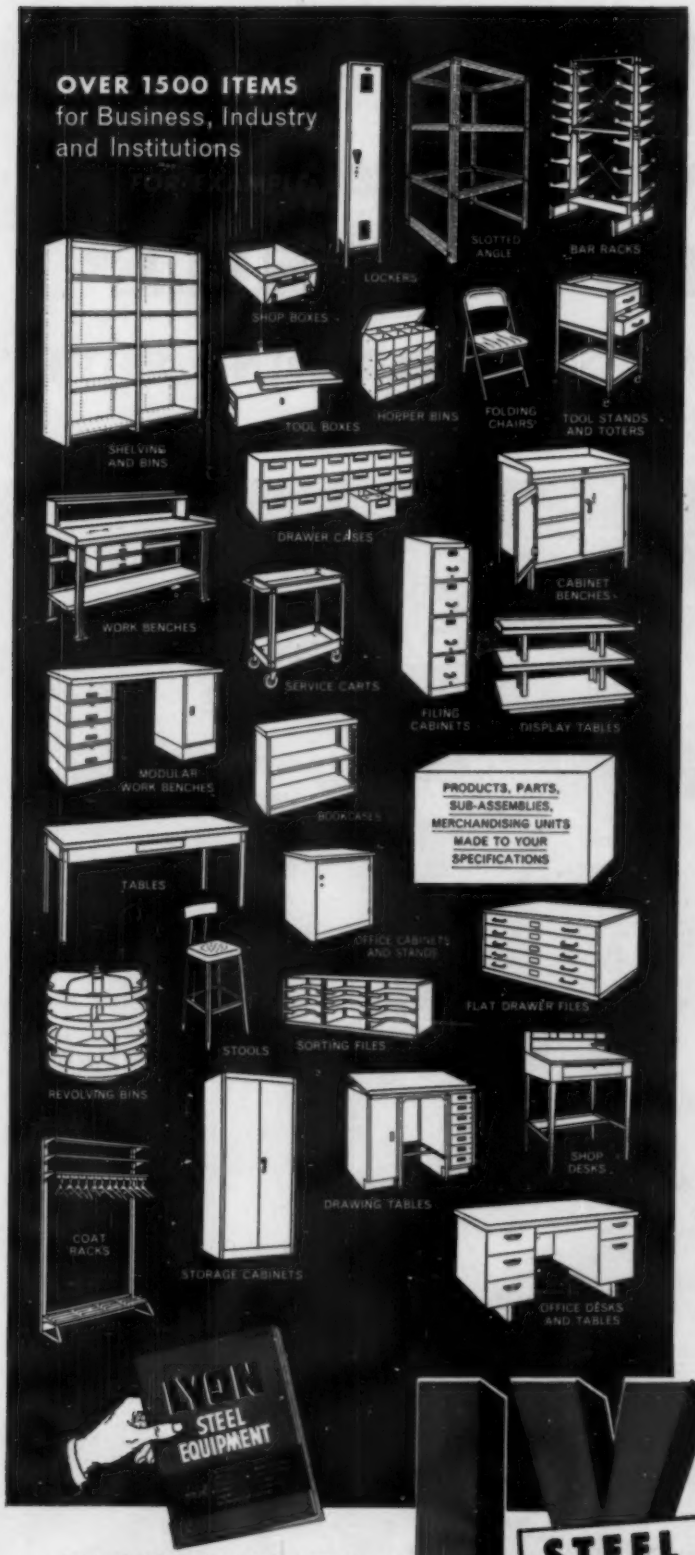

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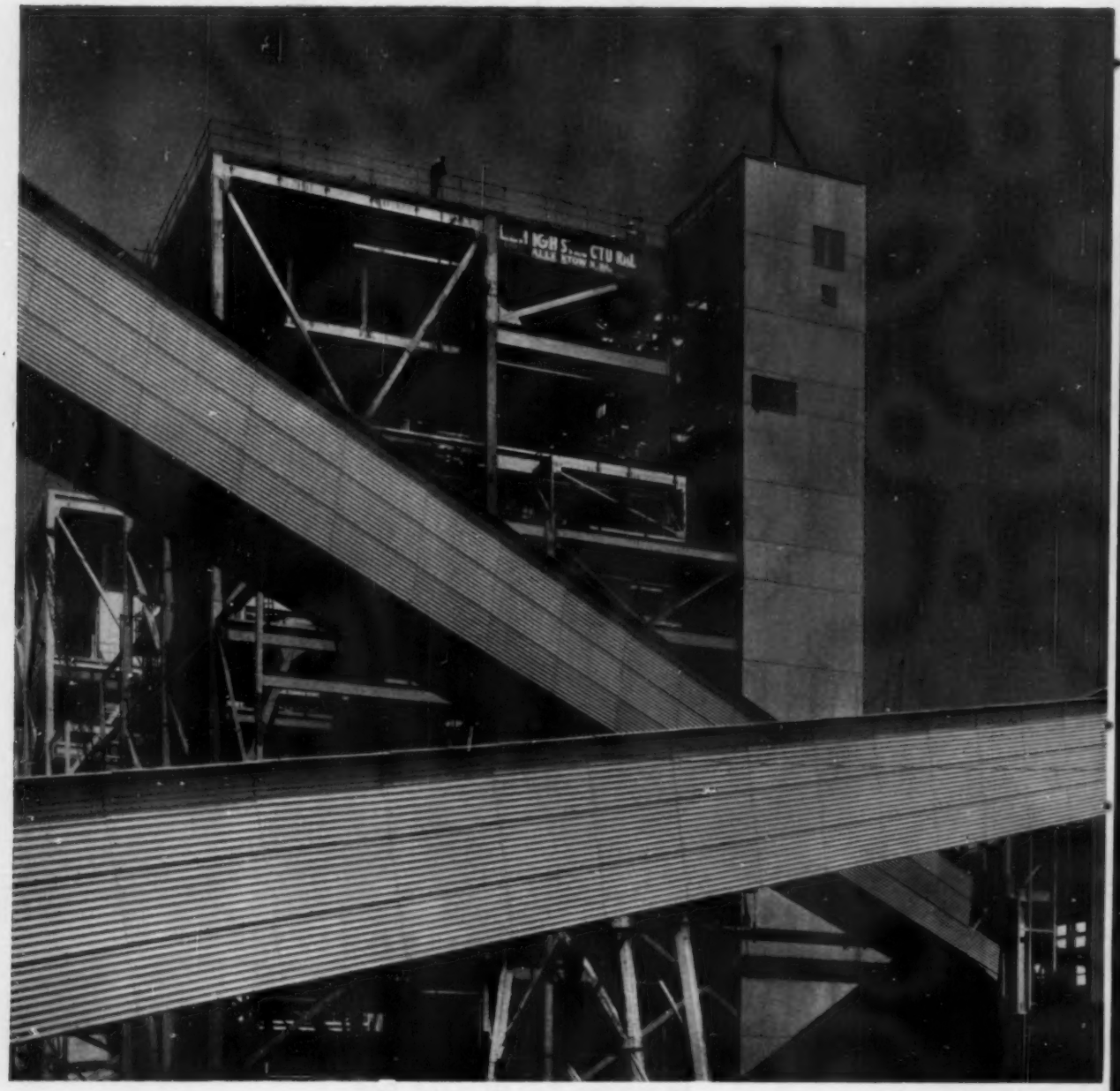

- big in size
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Corrugated Transite creates exterior walls that will cope with the most severe exposure conditions because Corrugated Transite is made of asbestos and cement . . . two practically indestructible materials. The picture of a power plant under construction, left, shows how sheets can be used either horizontally or vertically over minimum framing. At right is a corner detail.

BASIC FACTS ABOUT CORRUGATED TRANSITE
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Length: *3' to 12' in 6" increments*
Thickness: *Averages 3/8"*
Weight: *Normal 4.1 lbs./sq. ft.*

For complete information on physical properties, installation details and erection methods, write for 24-page, fully illustrated FREE BOOKLET *entitled, Corrugated Transite, TR-192A. This booklet also covers the companion material, Flat Transite. Address Johns-Manville, Box 158, Dept. PE-1060, New York City 16. In Canada, write Port Credit, Ontario.*

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Why a Steam Trap Has to Handle "Air"

Low temperatures and corrosion of equipment are often evidence of inadequate trap air venting capacity

Air, with its load of oxygen and carbon dioxide, has an unwholesome habit of interfering with the efficiency of steam heated units. If steam were always free of these undesirable companions, things would be a lot simpler for men-who-operate-plants. Because it isn't, three unhappy situations frequently occur:

1. ***Operating temperatures are subnormal.*** This is a two-part problem. First, an air-steam mixture has a lower temperature than pure steam at the same pressure—see Table A. Secondly, air can "plate out" on heat transfer surfaces as shown in Figure 1. Under some conditions, such an air film will knock down heat transfer efficiency by as much as 50%.

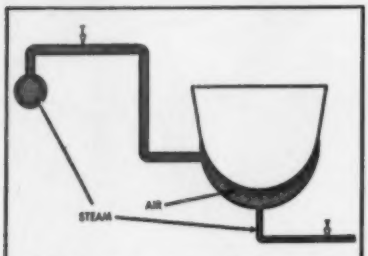


Fig. 1. *How air can "plate out" on heat transfer surfaces. This "insulation" drastically reduces heat transfer efficiency. Armstrong trap operation creates turbulence in the equipment that prevents this.*

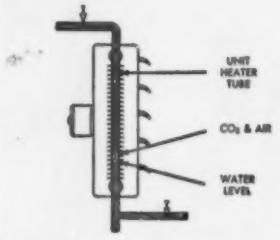


Fig. 2. *Corrosion occurs when units are not kept continuously free of both condensate and air. Armstrong traps discharge both,* at steam temperature, *as fast as they accumulate.*

2. ***Corrosion rears its ugly head.*** Oxygen and carbon dioxide are real trouble-makers. CO_2 gas goes into solution in condensate, forms carbonic acid and chews away at vulnerable metal sections. O_2 aggravates situation. See Figure 2.

TABLE A—How air reduces steam temperature.

Gauge Pressure	Temp. of Steam with No Air Present	Temp. of Steam Mixed With Various Amounts of Air (% Air by Volume)	
		10%	30%
10.3	240.1	234.3	220.9
25.3	267.3	261.0	246.4
50.3	298.0	291.0	275.1
75.3	320.3	312.9	295.9
100.3	338.1	330.3	312.4

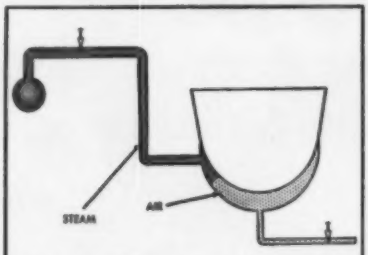


Fig. 3. *When steam is turned on, it takes a trap with extra air venting capacity to provide fast heat-up.*

3. ***Heat-up is slow as a snail.*** Air has a picnic in units that are shut off periodically. Figure 3 pictures the problem. Lines and equipment literally fill up with air. When the steam is turned on it can get in only as fast as the air gets out.

Enter Steam Traps

Curing these steam system ailments involves an operation sometimes called a "trap transplant." It consists of removing traps that don't get the air out and replacing them with traps that do.

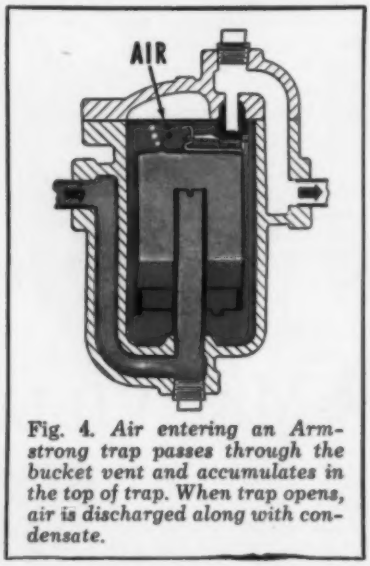
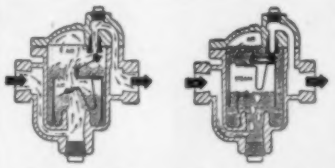


Fig. 4. *Air entering an Armstrong trap passes through the bucket vent and accumulates in the top of trap. When trap opens, air is discharged along with condensate.*

Figure 4 shows how an Armstrong inverted bucket trap continuously vents air. What the picture doesn't show is a built-in plus-value of this trap's design. An Armstrong trap opens suddenly, creating a momentary pressure drop and turbulence in the unit being drained. This breaks up air films and "pumps" air down to the trap so it can be vented.

The vents in standard Armstrong trap buckets will pass all the air normally encountered. In special cases, such as paper machine dryers, the vents are correctly sized larger at the factory to meet the requirement.



Thermostatic vent open. *Thermostatic vent closed.*

Fig. 5. *Open float with thermostatic vent for off-and-on units. When trap is cold, vent is open, permitting air to blow through when steam is turned on. When steam reaches trap, heat closes thermostatic vent. Then, regular bucket vent handles all air coming in with steam.*

Open Float with Thermostatic Vent

Super air-venting capacity is a must for fast heat-up of low pressure unit heaters, heating coils, steam headers and other units that are on-and-off. Figure 5 shows how the Armstrong open-float-with-thermostatic-vent trap takes care of this.

* * *

The 44-page Armstrong steam trap book covers other features of the Armstrong trap as well as its excellent air handling characteristics. This catalog also discusses trap selection, installation and maintenance. Your local Armstrong Representative or Distributor will be glad to give you a copy. Call him, or write Armstrong Machine Works, 9124 Maple Street, Three Rivers, Michigan.

ARMSTRONG STEAM TRAPS

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BJ Bilton Pumps

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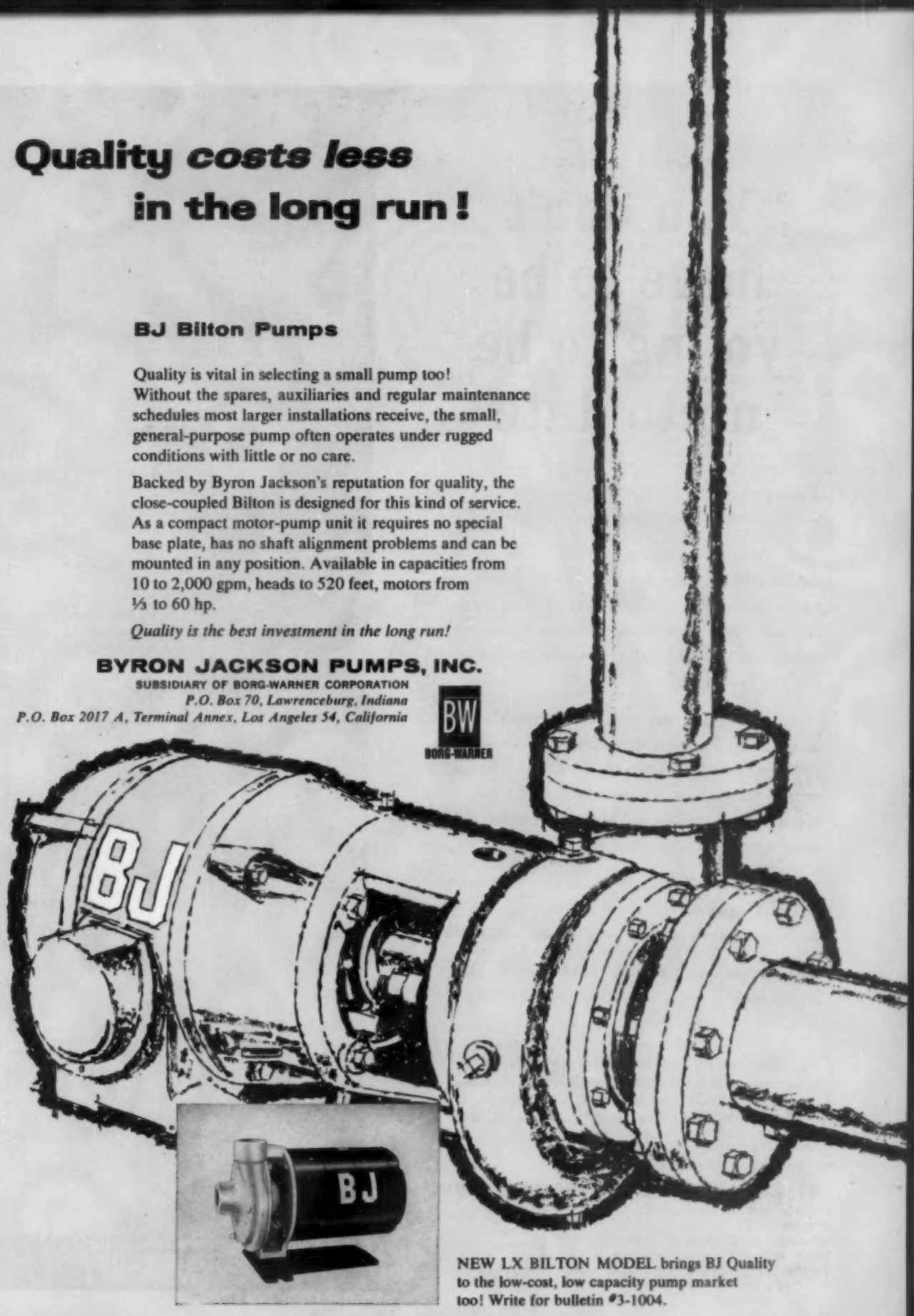

NEW LX BILTON MODEL brings BJ Quality to the low-cost, low capacity pump market too! Write for bulletin #3-1004.

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"I was past 50 when I learned about circuit breakers. Now I wouldn't use anything else.

"Sure, I'll admit the younger fellows are the ones who use circuit breakers the most today. They say it's because they're more up to date. Don't believe it. They just didn't have any old-fashioned habits to break, like some of us old hands did. And I can show you some youngsters who aren't up to date yet.

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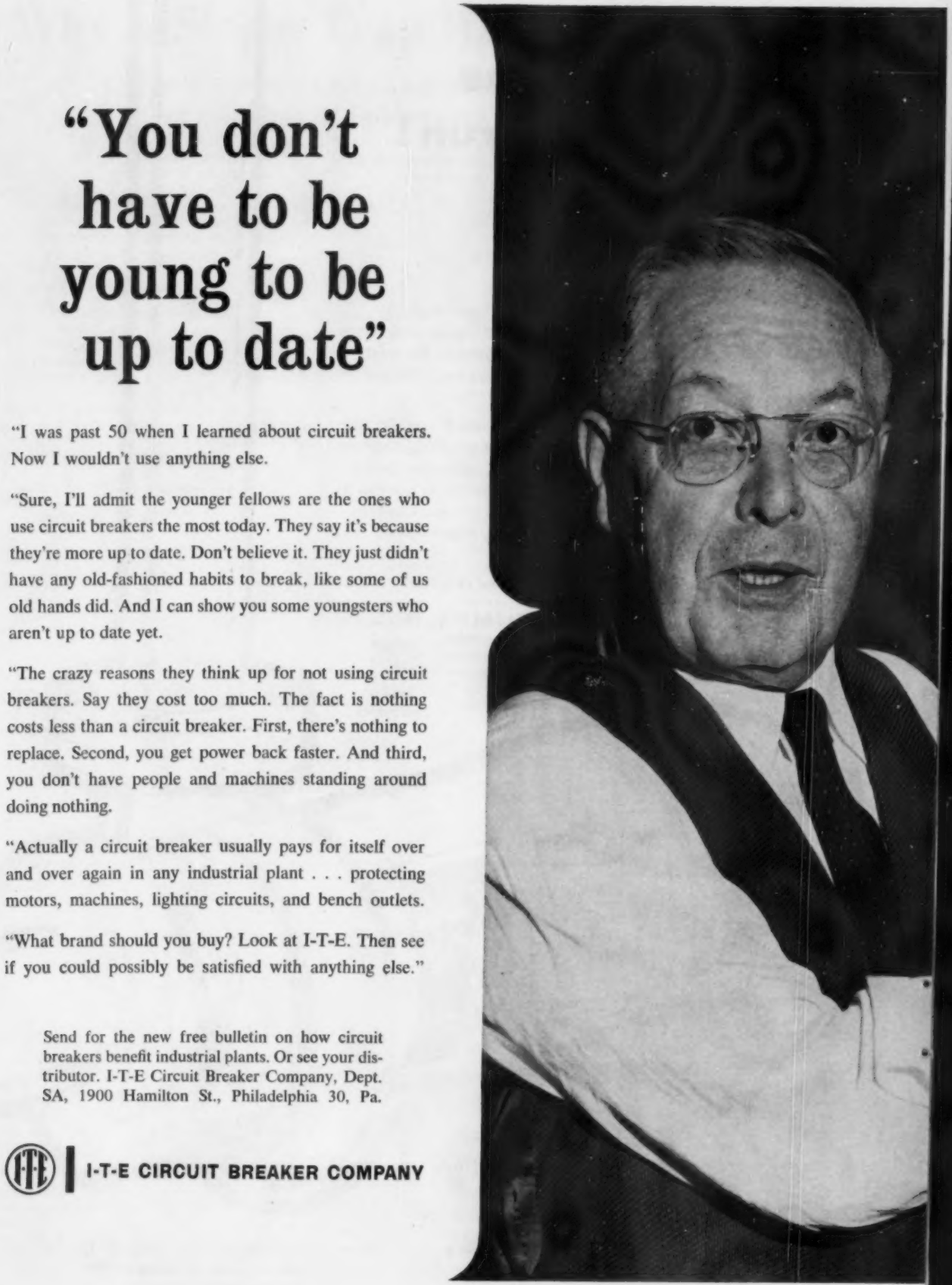
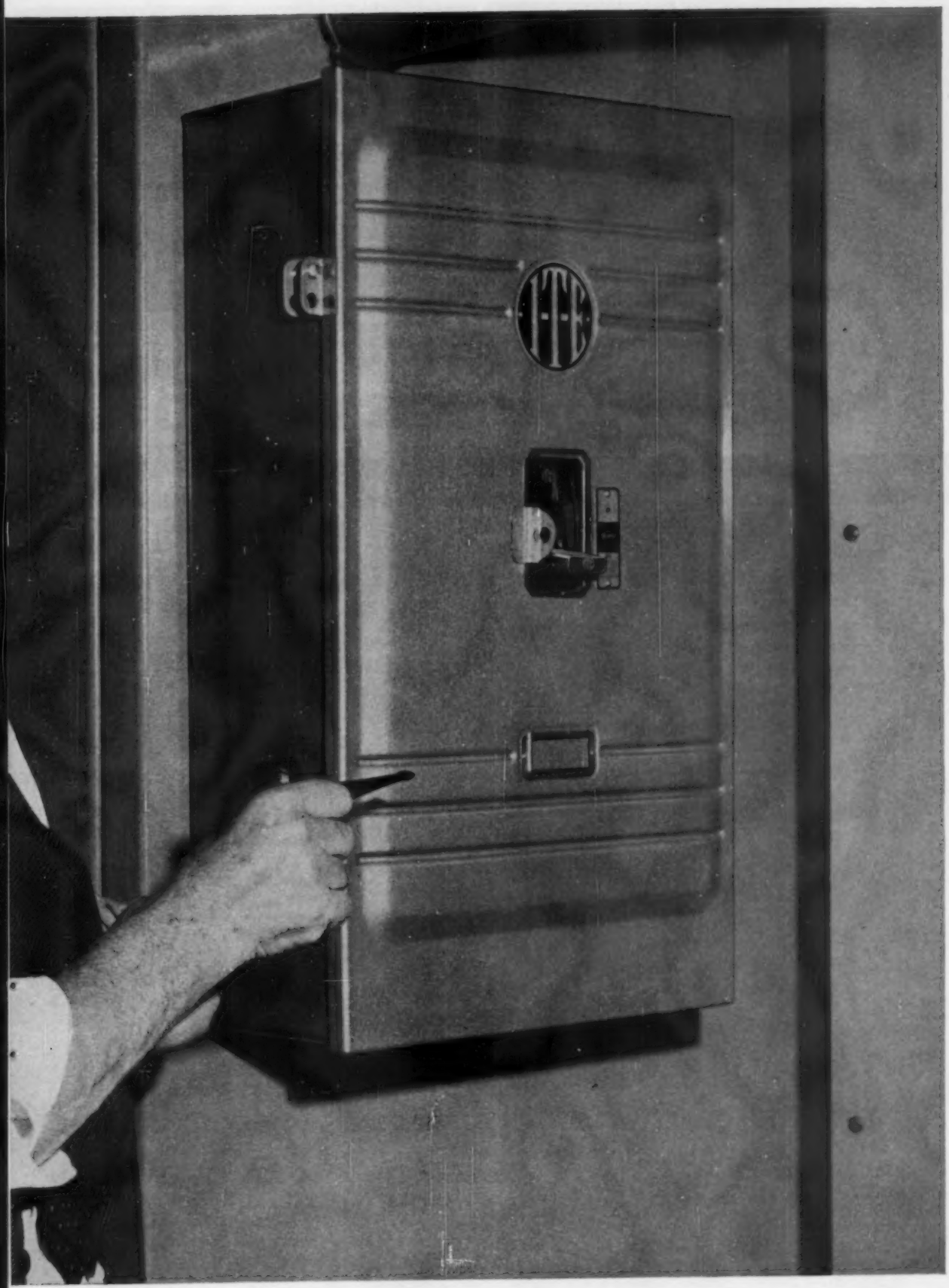
"Actually a circuit breaker usually pays for itself over and over again in any industrial plant . . . protecting motors, machines, lighting circuits, and bench outlets.

"What brand should you buy? Look at I-T-E. Then see if you could possibly be satisfied with anything else."

Send for the new free bulletin on how circuit breakers benefit industrial plants. Or see your distributor. I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton St., Philadelphia 30, Pa.



I-T-E CIRCUIT BREAKER COMPANY



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3 — 60,000 lbs./hr. Erie City Natural Circulation Keystone Package Steam Generators — oil fired — outdoors — a large eastern steel mill.

1 — 30,000 lbs./hr. Erie City Natural Circulation Keystone Package Steam Generator — gas and oil fired — outdoors — Southern Nitrogen Co., Savannah, Ga.

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Tangent Furnace Tubes — act as baffle, no heavy refractory tile required.

Tangent Outer Tubes — plus steel jacketed insulation keep heat loss to a minimum.

Welded Inner Seal Casing — eliminates casing corrosion problems.

If you are presently in the market for a water tube package generator or if future expansion may require a unit of this type, investigate the Keystone. You owe it to yourself to see one in operation before you buy. For detailed catalog information, write for Bulletin SB-6305-K.

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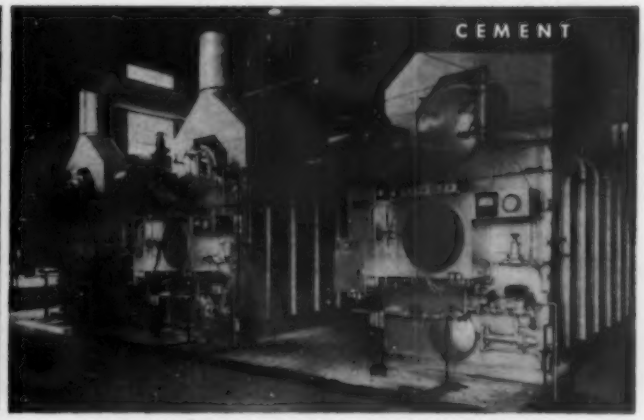
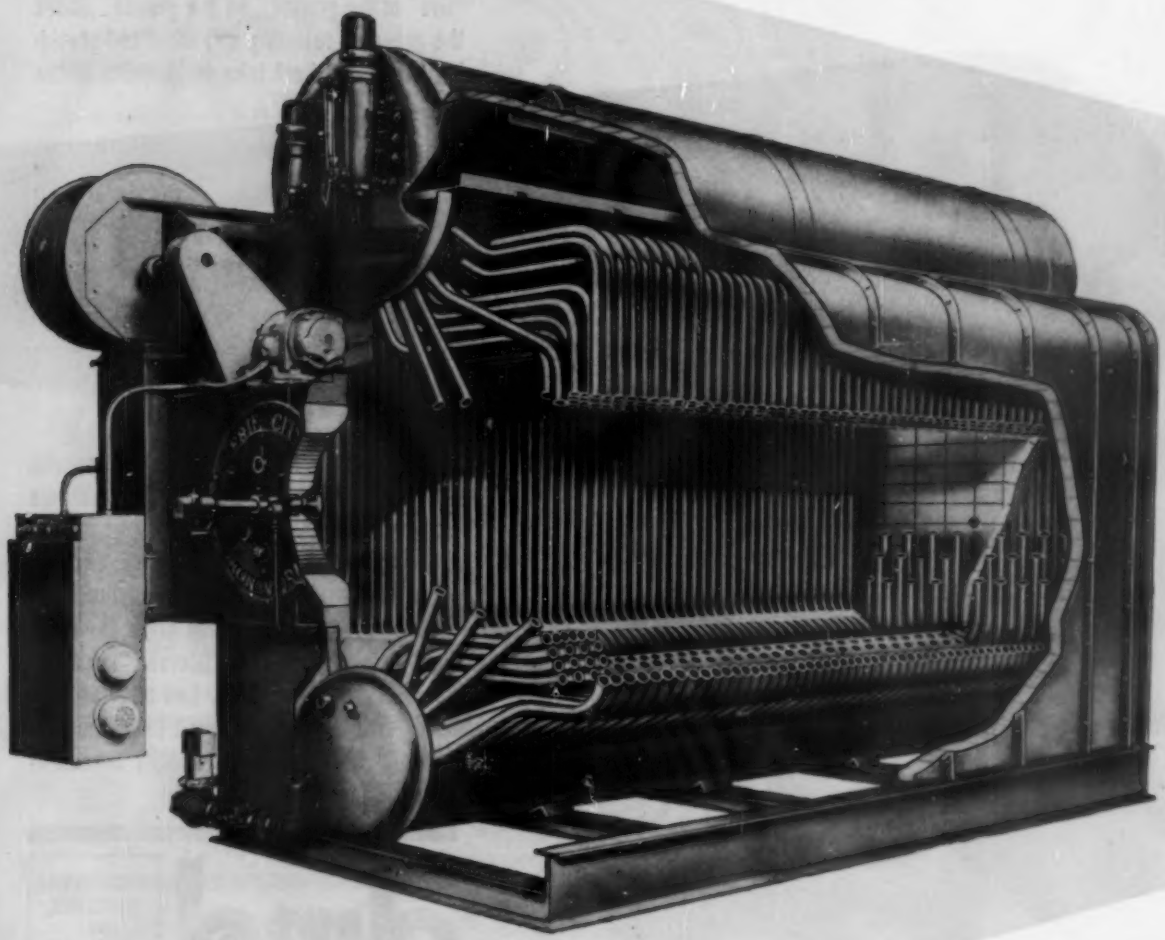
2 — 8500 lbs./hr. Erie City Natural Circulation Keystone Steam Generators — gas and oil fired — Eli Lilly & Co., Greenfield, Ind.



3 — 20,000 lbs./hr. Erie City Natural Circulation Keystone Steam Generators — oil fired — Fabrica Dominicana De Cemento, Ciudad Trujillo, Dominican Republic.

Steam Generators



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Fittings and couplings for grooved end pipe. Combines pipe joining dependability with positive lock. For working pressures 500 psi and 1.000 psi. Sizes 2" through 8".

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Absorb concentrated expansion and contraction of exposed pipelines. Built to order. All sizes.

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Repairs holes in steel pipes quickly. Resists corrosion and right for most line contents including oils. Sizes ½" through 8"; and 3", 6", 9", 12" lengths.

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Repairs holes and breaks in asbestos-cement, cast iron pipe with "all-around" pack. Sizes 2" through 14" in various lengths to 30".

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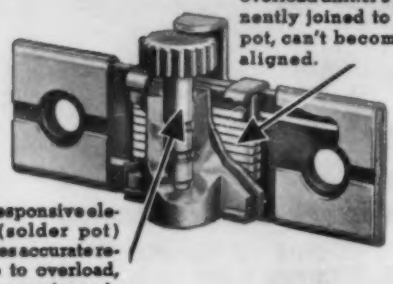

Heat-producing element is an integral part of overload unit. It's permanently joined to solder pot, can't become misaligned.

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CONSTRUCTION BRIEFS

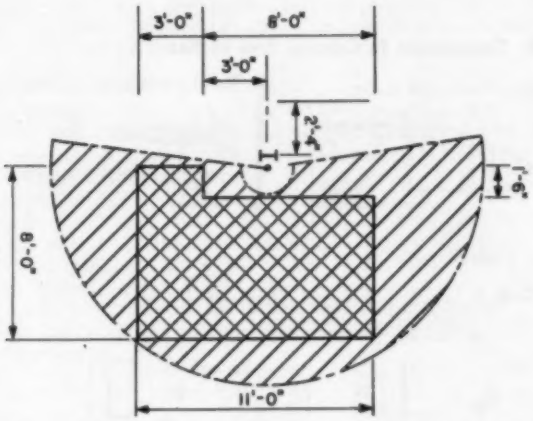
—a review of fundamentals for the plant engineer

Prepared by B. A. Wasil, Structural Engineer

DESIGN OF A JIB CRANE

A typical example of the structural problems faced by industry's plant engineers is this one: the machine shop needs a two-ton chain hoist in the vicinity of a milling machine. The plant engineer is to provide the design and supervise purchasing and construction.

Figure I indicates the area to be serviced by the hoist with reference to its nearest existing column. The figure also shows the area that could be serviced by a ten-foot radius column jib crane.



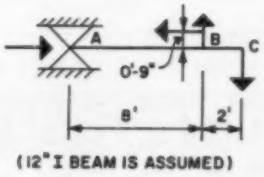
Service area required (cross hatched) and covered (lined).

Examining the structural plans of the plant it is found that the column is a 8 WF 24, 16 ft. 0 in. long, simply supported at both ends. The total load the column was designed for is 68 kips. It is felt that the column will have to be reinforced to support the jib crane.

First, to the design of the jib bracket. A two-ton chain hoist and trolley is purchased, the trolley designed to fit a 5-in.-wide I-beam flange.

DESIGN OF JIB BRACKET

1. Loads



MOVING LOAD

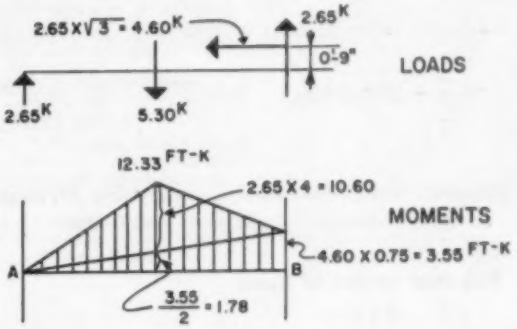
P = 4.00^K (LIVE LOAD)
0.30^K (WGT OF TROLLEY AND HOIST)
1.00^K (IMPACT-25%)
5.30 KIPS

Dead load will be neglected.

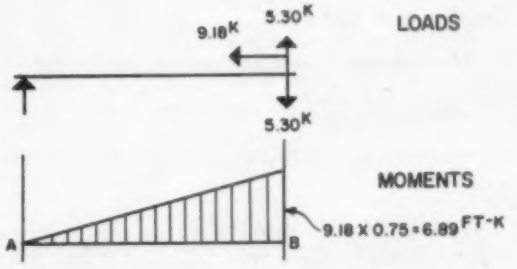
2. Maximum Moments

Where there is a moving load, the maximum moment diagram is a very important and useful tool in the design. The maximum moment diagram represents the envelope of all moment diagrams as the moving load moves from one end of the beam to the other. In other words the ordinates represent the largest (and the least) moment possible at each point.

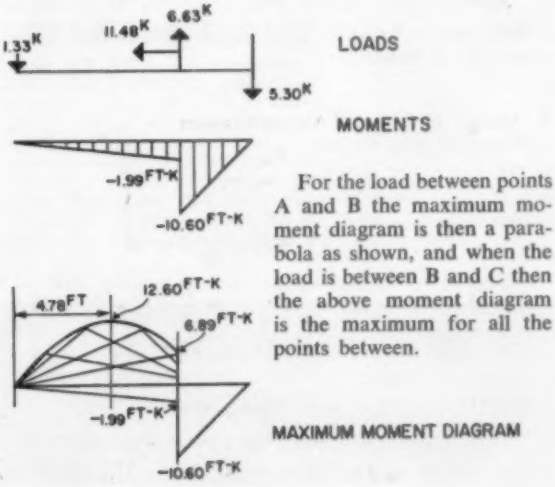
When the trolley is between points A and B then there is a simple beam with a concentrated positive moment at B due to the reaction of the rod being off-center from the beam. As an example, the moment diagram computed for the trolley located 4 ft 0 in. from A is the following:



When the trolley is at point B then the following figures hold:



When the trolley is at point C then the following is the moment diagram:



For the load between points A and B the maximum moment diagram is then a parabola as shown, and when the load is between B and C then the above moment diagram is the maximum for all the points between.

MAXIMUM MOMENT DIAGRAM

The location of the maximum value is obtained from the following equations:

$$M_x = \frac{5.30}{8}[8-x]\,x + \frac{x^2}{8}(.75)(\sqrt{3})(5.30)$$

$$M_x = 5.30\,x - .555x^2$$

$$\frac{dM_x}{dx} = 5.30 - 1.110\,x = 0$$

$X = 4.78$ ft.;

M at 4.78 ft. = 12.60 ft-kips

It should also be noted that between points A and B there is a compressive force equal to the horizontal reaction at A or B. This reaction varies with the location and the worst condition for design will be one of the following two:

Maximum Moment and Corresponding Compression

$M = +12.60$ ft-kips $\qquad P = \frac{-\sqrt{3} \times 5.30}{8} \times 4.78$

$P = -5.48$ kips

Maximum Compression and Corresponding Moment

$P = -11.48$ kips $\qquad M = -1.99$ ft-kips

3. Required Section of Beam

Try 12 I 31.8 beam

$A = 9.26$ in.^{2}; $S = 36.0$ in.^{3}

$$\frac{Ld}{bt} = 4.41 \times 12 \times 8 = 423$$

Therefore $f_b = 20{,}000$ psi

Double L because of lateral support on one end only:

$$2L/_r = \frac{2 \times 12 \times 8}{1.01} = 190$$

Therefore $f_a = 3890$ psi

Case 1.

$$\frac{12{,}600 \times 12}{36.0 \times 20{,}000} + \frac{5480}{9.26 \times 3890} = 0.36 < 1.00;\ \text{OK}$$

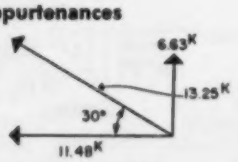
Case 2.

$$\frac{1990 \times 12}{36.0 \times 20{,}000} + \frac{11{,}480}{9.26 \times 3890} = 0.35 < 1.00;\ \text{OK}$$

While this beam offers much more strength than is necessary, it will be used.

4. Design of Rod and Appurtenances

Maximum load on rod:



Required root area of rod $= \frac{13{,}250}{20{,}000} = 0.663$ in.^{2}

Use 1⅛ in. dia. rod. Net root area = 0.693 in.^{2}

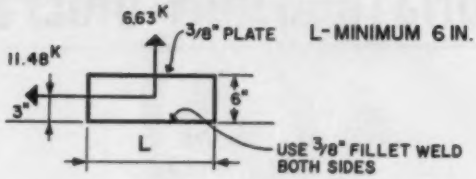
Pin size for clevises

Use 1⅛-in. pin and ⅜-in. plate as bracket

Double shear resistance 29.82 kips > 13.25 kips; OK

Double bearing resistance 16.90 kips > 13.25 kips; OK

5. Design of Bracket on I-Beam for Rod



Allowable stress for ⅜-in. fillet weld = 3.6 kips per in.

Try L = 6 in.

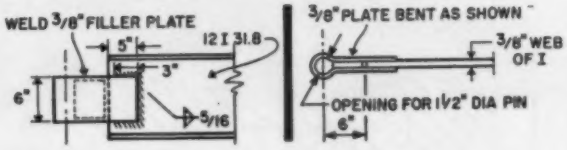
$$\text{Stress} = \sqrt{\left(\frac{11.48 \times 3 \times 3 \times 12}{2\,(6)^3} + \frac{6.63}{12}\right)^2 + \left(\frac{11.48}{12}\right)^2}$$

$$= \sqrt{(2.87 + 0.55)^2 + (.956)^2}$$

$$= 3.54 \text{ kips per in.} < 3.6;\ \text{OK}$$

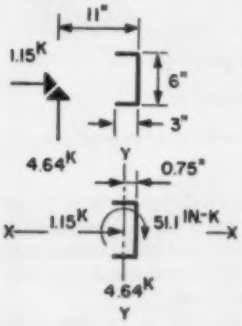
Use L = 6 in.

6. Connection to Column End of Beam

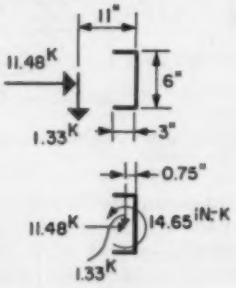


Check of Weld

Case 1.



Case 2.



Case 1. Trolley closest to column (assume 1 ft 0 in.)

Allowable stress on 5/16-in. weld = 3.0 kips per in.

$$I_{x\text{-}x} = 2 \times 3 \times 3^2 + \frac{6^3}{12} = 72$$

$$I_{y\text{-}y} = 2 \times \frac{3^3}{12} + 2 \times 3 \times (.75)^2 + 6\,(.75)^2 = 11.25$$

$I_p = 72 + 11.25 = 83.25$

$C_x = 3$ in; $\quad C_y = 2.25$ in.

$$\text{Stress} = \tfrac{1}{2}\sqrt{\left(\frac{1.15}{12} + \frac{51.1 \times 3}{83.25}\right)^2 + \left(\frac{4.64}{12} + \frac{51.1 \times 2.25}{83.25}\right)^2}$$

$$= 1.31 \text{ kips per in.} < 3.0;\ \text{OK}$$

Case 2. Trolley on furthest end of beam

$$\text{Stress} = \tfrac{1}{2}\sqrt{\left(\frac{11.48}{12} + \frac{14.65 \times 3}{83.25}\right)^2 + \left(\frac{1.33}{12} + \frac{14.65 \times 2.25}{83.25}\right)^2}$$

$$= 0.79 \text{ kips per in.} < 3.0;\ \text{OK}$$

The design of the jib crane will be continued in a subsequent Brief.

SARCO TOPICS

HOW TO PREVENT FREEZING OF HEATING COILS

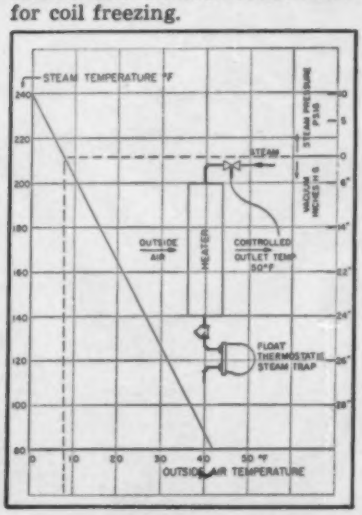
Despite the *best* "non-freeze" construction, air heating coils handling incoming air even slightly below 32° F are subject to freezing—*if they're not properly drained.*

Are traps to blame?

Under such conditions it is easily assumed that steam trap capacity is inadequate. However, there are other, more likely reasons. Since the discharge capacity of a steam trap depends upon the pressure differential between trap inlet and outlet, a zero pressure difference will result in zero capacity, no matter how large the valve seat is.

Why coils freeze

If the pressure at the trap inlet falls lower than pressure at the outlet, condensate cannot be discharged and will be held back in the coil. Condensate held in the coil is bound to freeze if the temperature of the air is below 32° F. As an example, consider a preheat coil designed to heat air from 0° F to 50° F, using steam at a maximum pressure of 10 psig. The chart below indicates that, as the outside air temperature rises above 0°F, the heat demand decreases, the temperature *controller reduces the steam pressure* to compensate for this reduced heat demand—and the stage is set for coil freezing.



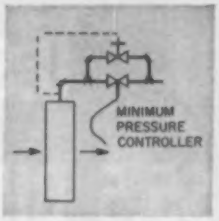
At left: chart shows how steam pressure in the heater is decreased by the modulating control as outside air temperature increases. Note that when outside air temperature reaches 7° F the pressure drops to 0 psig. In other words, unless special provisions are made there will be no pressure difference across the steam trap.

The remedy: 3 practical hook-ups

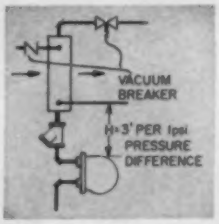
Starting with a correctly sized steam trap—and the Sarco Float Thermostatic is recommended as best suited to this type of application—freezing can be cured by preventing the pressure differential across the trap from falling below the minimum needed to discharge all the condensate as rapidly as it forms. Here are three practical methods.

1. Arrange a pressure controlled bypass around the temperature control valve

This keeps the pressure in the heater from falling below a preset minimum. With this solution, however, the temperature controller is not effective over the full range of outside air temperature.



Schematic hookup for pressure controlled bypass around temperature control valve.



Hookup for installing steam trap below unit.

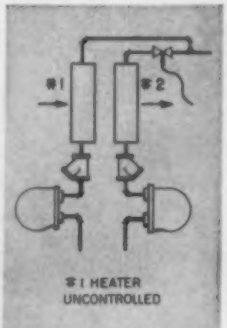
2. Install the steam trap well below the unit

This provides a hydraulic leg which allows the trap to discharge even with a vacuum in the steam space. A vacuum breaker should be installed at the top of the condensate header of the heater. To calculate the hydraulic head needed, use 3' per 1 psi pressure differential.

Example: if trap has required capacity at 1 psi differential, minimum head is 3'.

3. For a new installation, divide the preheater into two sections

The first section should be capable of raising the air to at least 32° F under minimum outside air conditions and the second to raise the air from 32°F to the final temperature. The first coil would be supplied with steam at full pressure at all times, while the second would be controlled to maintain the final temperature needed. The first coil could not freeze because of steadily maintained pressure, and the second would not freeze because the air temperature would be above 32° F.



Hookup for dividing preheater into two sections.

FIGURE IT OUT AT A GLANCE. "FREEZING POINT DANGER KIT" — FREE. Contact your Sarco Sales Representative, or write

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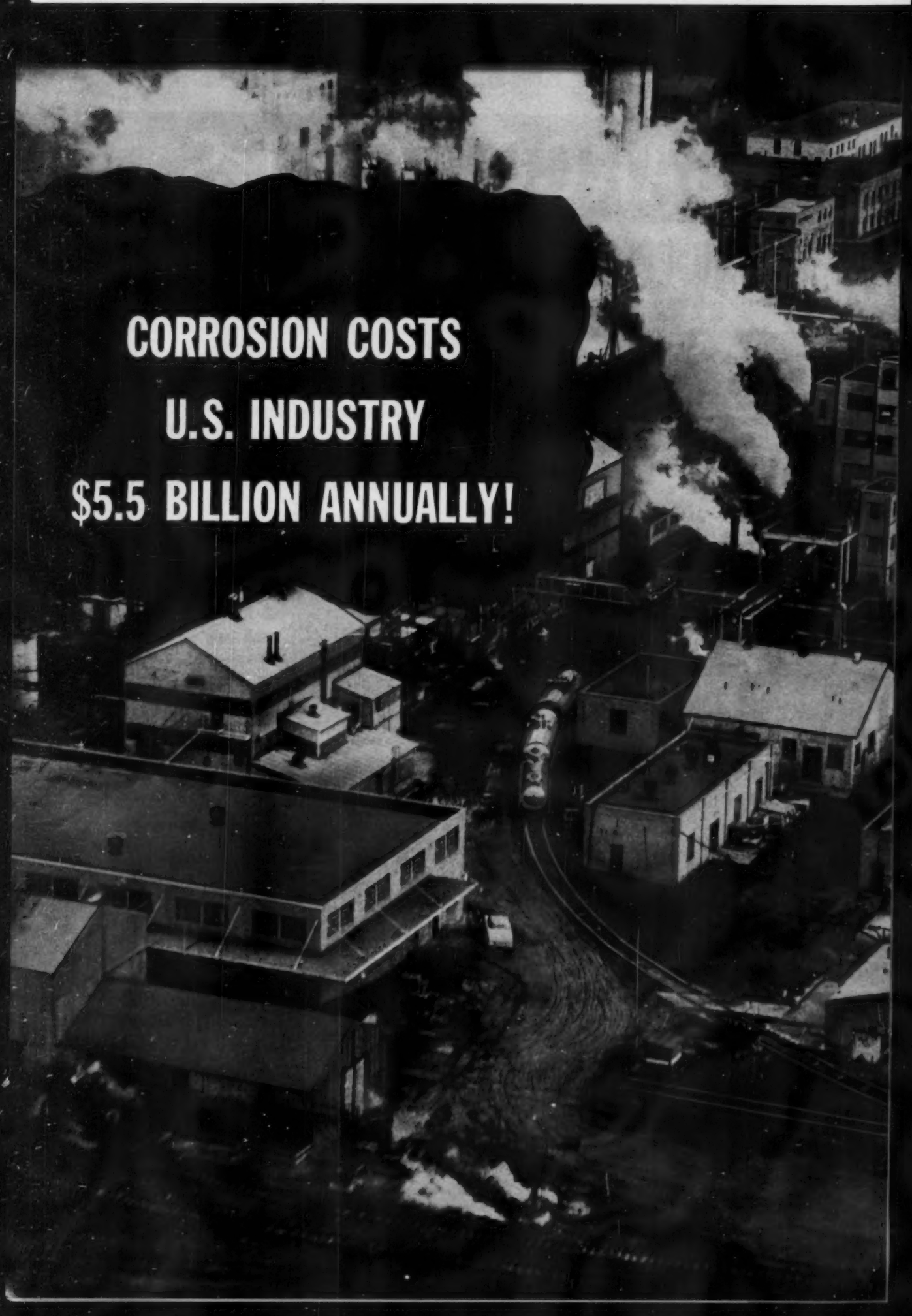
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U.S. INDUSTRY
$5.5 BILLION ANNUALLY!

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More and more corrosion engineers are turning to the *complete* PITT CHEM System of thick-film, cold-applied coatings for efficient long-lasting protection against corrosion. The PITT CHEM system is composed of over 20 different coatings, each formulated to control a specific type of industrial corrosion—from the most ordinary to the most severe—at minimum cost.

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INDUSTRY CORROSION DATA FILE

Includes a survey of corrosion problems in general industry, data on PITT CHEM Coating Systems and a coating selector guide.

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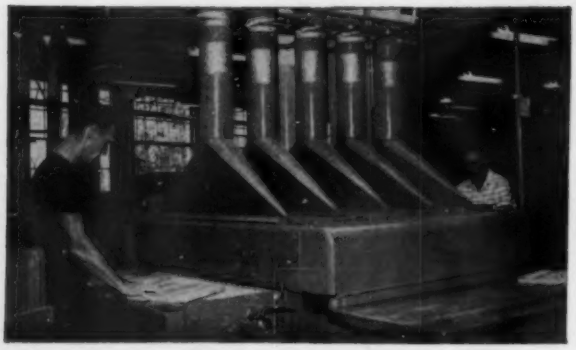
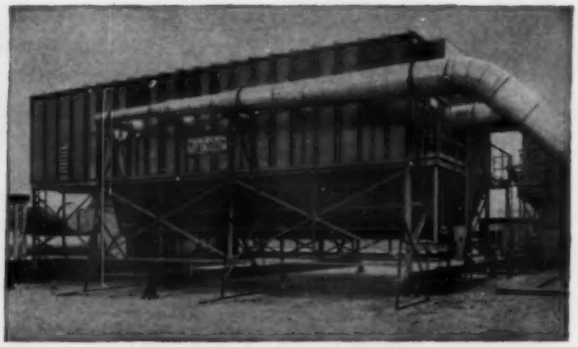
Operation: Dust Control

(One of a series)

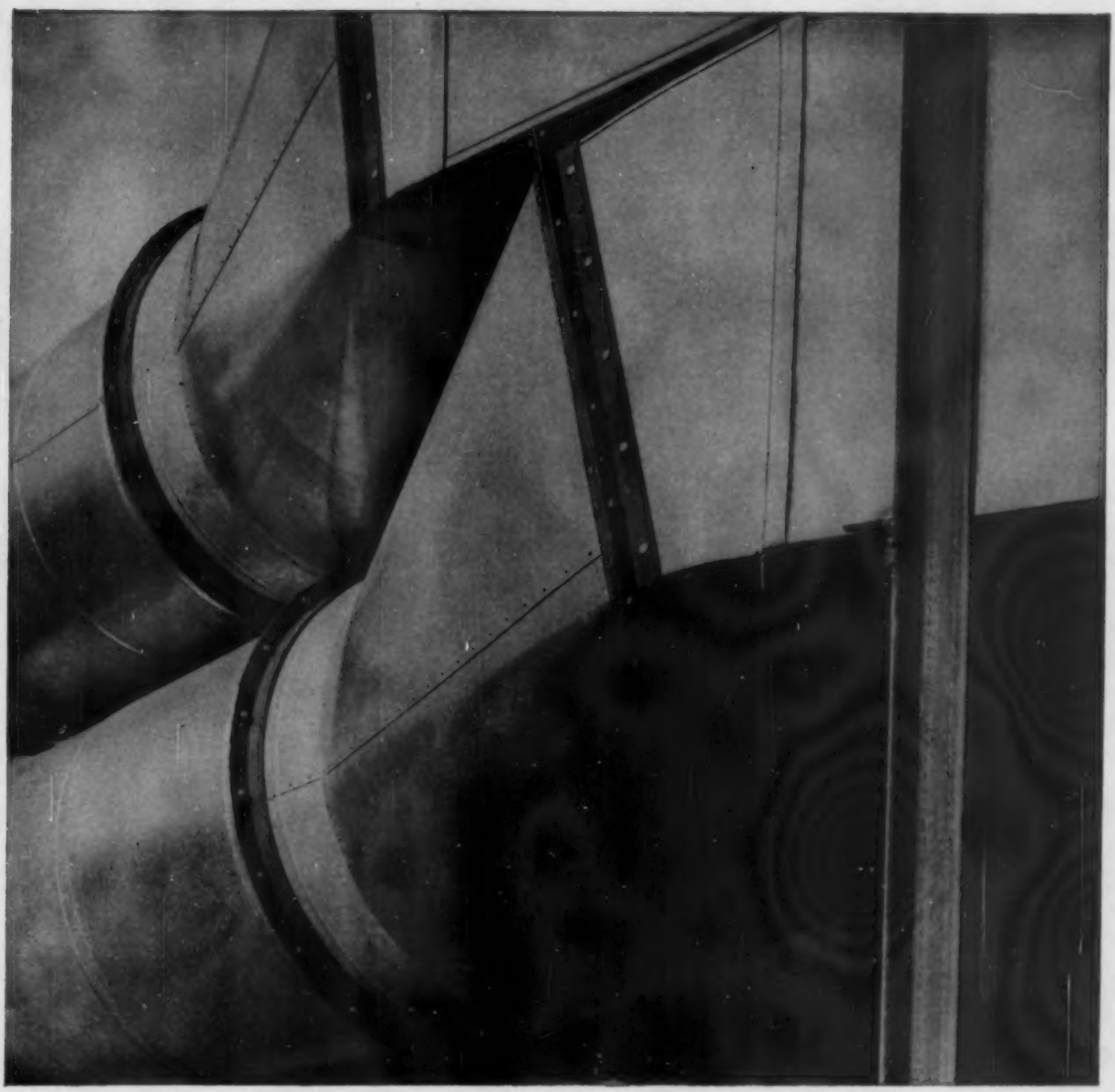
At National Cash Register, 10 tons of wood



Dust is trapped at the source by hoods engineered for the individual job . . .



. . . and is piped from 160 locations to five giant Pangborn Cloth Bag Collectors.



shavings, chips and dust are collected daily!

Mammoth is the word for the 5-floor woodworking plant of National Cash Register headquarters, Dayton, Ohio. Processing nearly 300,000 sq. ft. of lumber each month, this operation generates 10 tons of waste material per day.

To protect NCR employees, equipment, plant and neighborhood, five Pangborn Cloth Bag Dust Collectors trap 90 cu. ft. of fine dust for disposal and, during the winter months, permit recirculating of the already-heated, cleaned air. This efficient performance of Pangborn Dust Control saves thousands of dollars in heating costs during the cold weather. In addition, a neighborhood and health nuisance has been eliminated; equipment maintenance and plant housekeeping costs have been minimized.

Dust a continuing problem in *your* plant? Talk to the Pangborn man in your area or write: PANGBORN CORPORATION, 3200 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Dust Control, Blast Cleaning, Vibratory Equipment—Rotoblast® Steel Shot and Grit.®*

Pangborn
OF HAGERSTOWN

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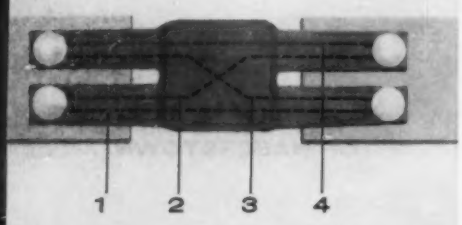
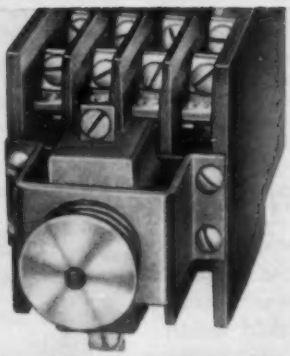
Another Cutler-Hammer first! Up to 24 poles in an area less than the size of a dollar bill.

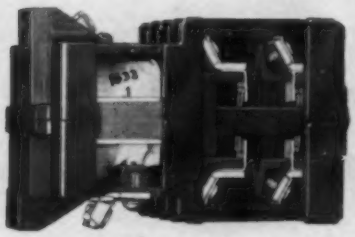
New contact reliability. Parallel bifurcated contacts, which allow four current paths instead of one, provide infinitely greater circuit reliability . . . liberally designed so any current path carries full relay rating.





At last! "Mechanical memory" latch as reliable as the relay itself! No adjustment ever needed. Add latch at any time.

New simplified design! Cutaway view shows basic simplicity. Coil vacuum impregnated to resist damage from humidity, vibration, electrical stress. Terminals can be screw or spade type.



Space savingest relay you've ever seen: New Cutler-Hammer "Compact 300"

Versatile 300 V. control relay is so reliable it's permanently sealed!

Here is the best answer yet to the need for an extremely reliable, small-size 300 V, 6 amp., industrial relay — the new "Compact 300" from Cutler-Hammer.

Every detail known that affects relay reliability has been improved in the "Compact 300." Bifurcated contacts which make possible *four* current paths rather than one, add millions of operations to the "Compact 300's" electrical reliability.

In fact, we're so confident of its electromechanical reliability, we permanently enclose the "Compact 300." And, if it should be damaged by a fault current, you throw it away and replace it with a new one. Its low price makes this an economical, practical maintenance procedure.

Now think of the space you can save with the "Compact 300." It controls up to eight circuits in panel space only 2″ wide by 2¾″ high. 2, 3, 4, 6 and 8 poles with any combination of N.O. or N.C. contacts are available, of course.

At any time, you can add "mechanical memory" latch with a life equal to the life of the relay. No adjustments are ever necessary. Contact your Cutler-Hammer distributor for details on the "Compact 300" or send for Pub. ED-L079-S274.

What's new at Cutler-Hammer? New, better products, like the 300 V. relay are coming steadily from our new, expanded plant facilities. We're ready now to help you take care of the great industrial growth of the future. If you are planning ahead and need electrical control assistance, contact the nearest Cutler-Hammer sales office.

WHAT'S NEW? ASK...

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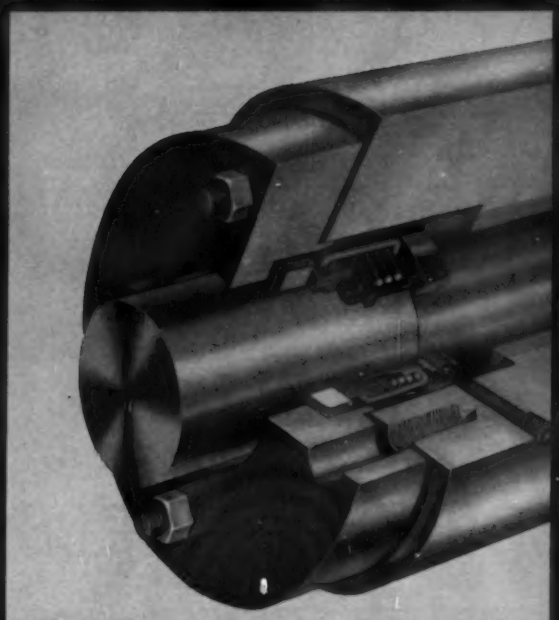
LATTICE-BRAID Packing lasts far beyond the limits of other packings . . . once installed, rarely requires further gland adjustment. Gives maximum service life over a wide range of temperatures, pressures. Only Garlock can give you LATTICE-BRAID.



PK MECHANIPAK Mechanical Seals are self-contained, can be installed simply and quickly, eliminate adjustment during operation. Offer leak-proof sealing without shaft wear.

GUARDIAN Gasket V-shaped metal plies have an automatic spring action that reacts to variations in compression, internal pressures, and temperature changes. Assure leak-proof seal under most severe conditions.

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for Plant Maintenance

PROTECT EQUIPMENT FROM DAMAGE DUE TO HIGH PRESSURE, TEMPERATURE

Now, more than ever, plant engineers and maintenance men specify Garlock PK MECHANIPAK* Seals, LATTICE-BRAID* Asbestos Packings and GUARDIAN* Gaskets for safe, long lasting prevention of equipment failure due to high pressures and temperatures.

Garlock PK MECHANIPAK Mechanical Seals are easy to install and maintain. They are completely self-contained . . . no parts to put together. Rotating portion simply slides onto shaft; stationary portion positions quickly. Once installed, further adjustment is unnecessary. No parts of the seal move on the shaft or sleeve, eliminating wear on the shaft. Available in shaft sizes from 3/8" to 3" . . . operate at temperatures to 212°F, pressures to 150 psi, shaft speeds to 2000 fpm. Catalog AD-150.

Garlock LATTICE-BRAID Packings are engineered for longer packing life. They employ a through-and-through braiding construction. As illustrated above, each strand passes diagonally through the packing at a 45° angle. This unique construction makes a completely unified structure, resulting in greater strength. Since there is no single outer braid to wear through, Garlock LATTICE-BRAID will wear far beyond the limits of ordinary packings. Applicable against water, steam, oil, gases and chemicals to 700°F. Catalog AD-131.

Garlock GUARDIAN Gaskets provide a safe, positive seal against high temperatures and pressures of steam, oils, gases, liquids. Construction assures dependable sealing under varying service conditions. Strips of V-shaped metal, alternated with layers of asbestos or Teflon†, are spiral wound to form the gasket. A predetermined density is introduced into the gasket to satisfy application requirements. Used at temperatures to 1050°F, pressures to 2500 psi . . . available in round, oval, square, flat side, diamond, pear and other shapes in practically any size. Catalog AD-104.

GARLOCK

For more information, contact the nearest of Garlock's 26 sales offices and warehouses throughout the U.S. and Canada. Or, write for catalogs. Garlock Inc., Palmyra, New York.

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*Registered Trademark
†DuPont Trademark for TFE Fluorocarbon Resin

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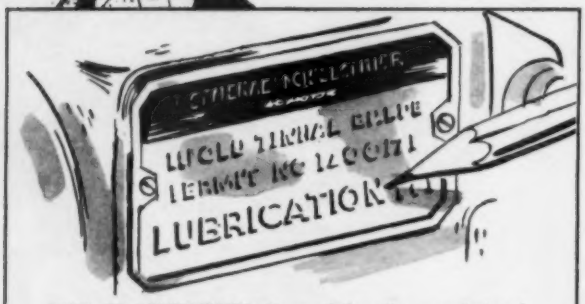
DISTRIBUTOR DAN, the SKF bearing man, offers

FIVE TIPS ON BEARING LUBRICATION

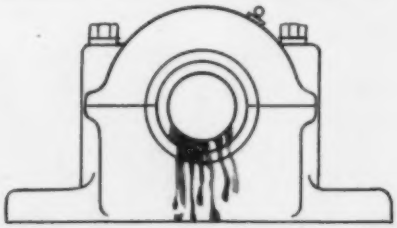
—that can save time and trouble for you



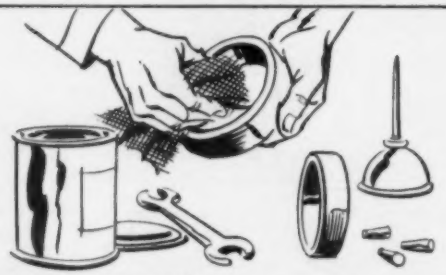
WHEN TO RE-LUBRICATE? Always follow the manufacturer's directions, if they're available. Most bearings, whether oil- or grease-lubricated, need cleaning and re-lubrication once a year. Re-lubricate oftener if the bearing is large, operates at high speeds or temperatures of 120-140 F. or higher.

WHAT GREASE CAN TELL YOU. Grease itself can tell you when cleaning and re-lubrication are needed. Dark grease means that oxidation has started or that abraded particles are present. Changes in the original color indicate water. Grease of a hard consistency should always be replaced.

WHEN TO CHANGE OIL. Compare the oil in the bearing with unused oil. Clouded oil indicates water. Dark oil frequently indicates sediment. Dark, pitch-like coatings on the rings, roller ends or cage mean the oil has become dirty or begun to carbonize. So, clean the bearing and housing and re-lubricate.



TOO MUCH IS WORSE THAN TOO LITTLE. Don't overlubricate. Only grease that actually contacts the bearing lubricates. Using too much grease may cause churning and lead to overheating and loss of lubricant. Remember: the higher the speed, the more sensitive a bearing becomes to excessive lubrication.



CLEANLINESS, FIRST AND LAST. Clean new oils and greases will usually force-out old lubricants in the bearings. But they won't if the lubricant is badly oxidized. Pour a hot aqueous emulsion into the housing. Rotate shaft until bearing is clean. Drain solution while rotating shaft. Then, flush with hot light oil, drain and add new lubricant.

Baffled by a bearing problem? Whether it's selection, mounting, or maintenance — consult your Authorized SKF Distributor. He's staffed to help you keep them running smoothly and he stocks all the bearing types and sizes you need.

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Spherical, Cylindrical, Ball, "Tyson" Tapered and REED Miniature Bearings

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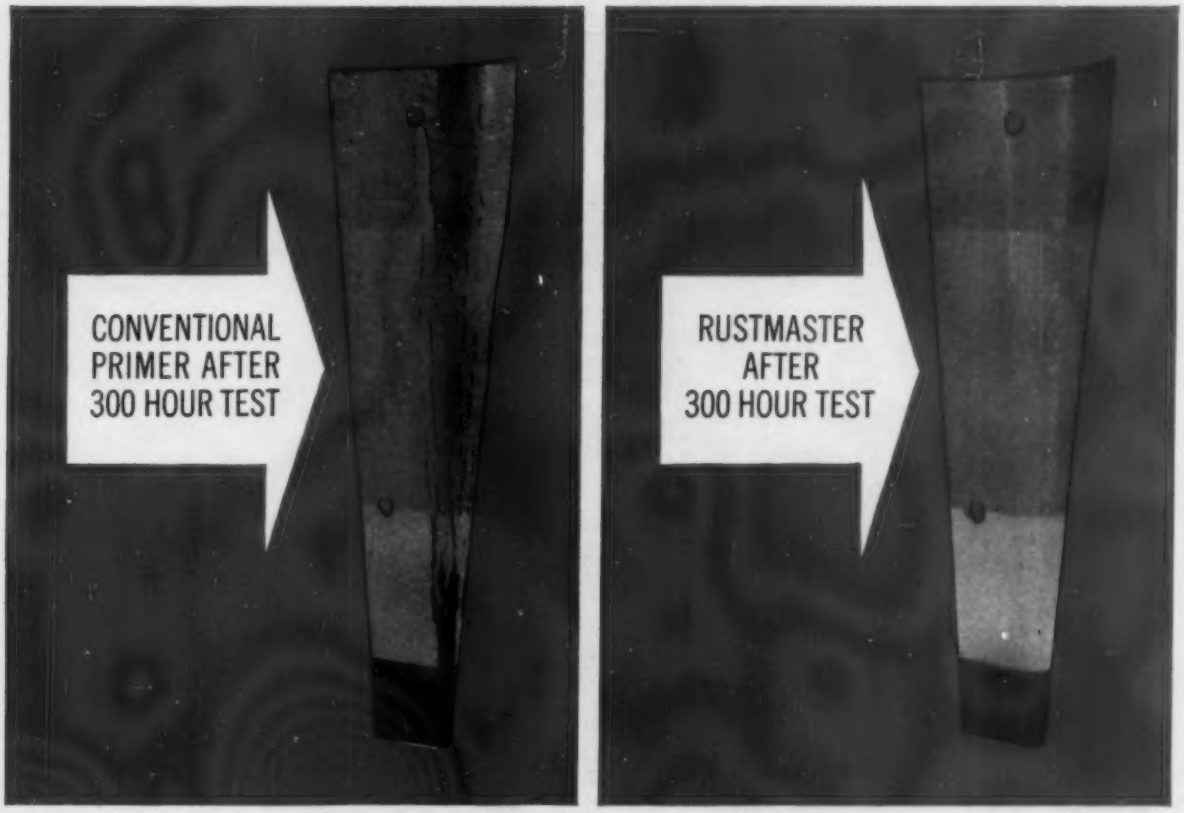
Rustmaster Metal Primer is 27% more corrosion resistant



Special wetting additive penetrates rust faster, more thoroughly

Tests prove that RUSTMASTER is 27% more effective; it gives a stronger, more flexible, more corrosion-resistant finish.

RUSTMASTER Tank and Structural Primer molecules —containing a special wetting additive*— penetrate all the way through rust, carrying *both* vehicle and anti-corrosive pigment to the bare metal surface. Corrosive air and moisture are forced out.

RUSTMASTER Tank and Structural Primer dries fast. Overnight recoat schedules permit rapid completion of maintenance painting.

RUSTMASTER Tank and Structural Enamels provide an interior and exterior finish with exceptional resistance to weather and light chemical exposures. RUSTMASTER Heat-Resisting Finishes maintain protective qualities and appearances on heated surfaces up to 1200°F.

The RUSTMASTER system can help you in your Protective Maintenance Program. Write today for details.

*Patent applied for

MAINTENANCE FINISHES DIVISION
The Glidden Company
900 Union Commerce Building • Cleveland 14, Ohio
In Canada:
The Glidden Company, Ltd., Toronto, Ontario

QUALITY Glidden PRODUCTS — General Paint

For more facts circle 563 on Reply Card

EXPLOSION-PROOF

Killark explosion-proof light fixtures provide approved protection for Class 1, Groups C and D; Class 2, Groups E, F, G installations. Special inner reflector plays important part in excellent lighting efficiency. Pendant, ceiling, bracket and flush mountings. Shock-proof, heat-resistant annealed globe. 60 to 500 watt.

DUST-TIGHT

Approved light fixtures for use in Class 2, Groups E, F, G hazardous locations. Vertical design keeps dust from accumulating, close fitting parts keep it from entering fixture. Coolest burning dust-tight lights mean added safety. 100 and 150-300 watt sizes.

SPECIAL LOCATIONS

Conch light
Many applications—indoors or outdoors. Attractive fleur-de-lis design. With or without switch.

Flood light
Weather proof in any position. Styles for PAR-56 and PAR-64 sealed beam lamps.

Sealed beam light
Variety of single or cluster styles, adjustable mountings. Sealed against weather. PAR-38 and R-40 lamp styles.

Louver light
For steps, passageways, small signs. Easily installed and serviced.

Mushroom island light
Basic island light, plus one to five sealed beam spot lights, as required. Ideal for service stations, parking lots, etc.

Dekorative light
Gives added beauty. Pendant or ceiling mounting, frosted or clear globe. 60-100 and 150 watt lamps.

Killark

ELECTRIC MANUFACTURING CO.

Vandeventer and Easton Ave. • St. Louis, Missouri

In Canada: Killark Electric of Canada, Ltd., 421 Islington Ave. South, Toronto 18, Ont.

VAPOR-TIGHT
The Killark line has vapor-tight light fixtures for every outdoor or indoor need. Design simplicity and interchangeable parts makes these lights easy to install and service. Positively weather-proof. Pendant, ceiling, bracket mountings, 60 to 500 watt.
ACCESSORIES
Write for the Killark lighting catalogs.

Wherever protected illumination is needed...

KILLARK LIGHT FIXTURES SERVE WITH DEPENDABILITY

A complete line of industrial and commercial lighting fixtures allows Killark to serve all types of installations with proper protected lighting. The Killark ability to supply exact needs means maximum safety, convenience, and efficiency—for both hazardous and non-hazardous locations.

All Killark fixtures are cast from aluminum to provide important extra advantages. Installed inside or outdoors, they remain permanently rust-proof. They give outstanding service in many areas where corrosion is a problem. Aluminum also dissipates heat at a much faster rate, and is safer because it's non-sparking.

Simplicity of design is still another reason for the superior performance of Killark light fixtures. Most styles have interchangeable parts to allow quick, inexpensive changes in mounting method, wattage capacity, type of globe, or reflector. Relamping can be done easily without tools.

Your Killark dealer can supply these fine light fixtures promptly—from his stock or one of the nineteen Killark warehouses in the United States and Canada.

Killark light fixtures are U.L. and C.S.A. approved.

SOLD THROUGH WHOLESALERS FROM COAST TO COAST AND IN CANADA. WAREHOUSE STOCKS IN NINETEEN CITIES.

6025

PLANT ENGINEER'S PICNIC

It's amazingly simple to design a complete Stromberg-Carlson sound communications system from easy-to-assemble components.

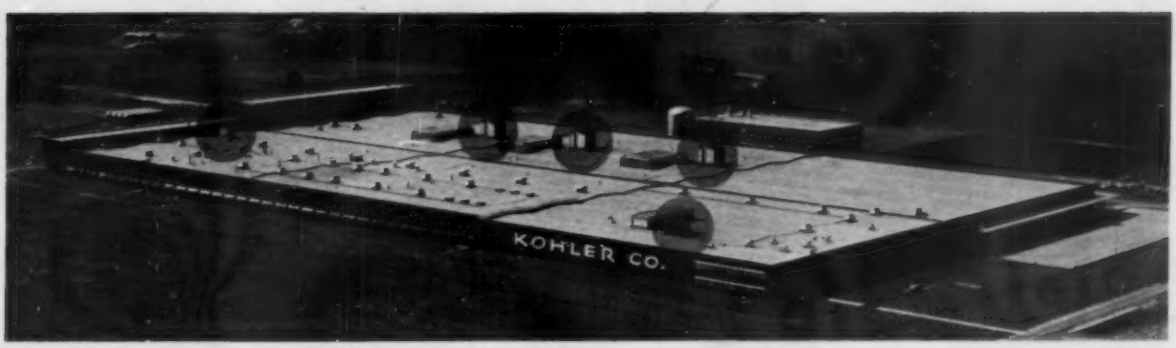
No soldering, no special cabling—everything fits together beautifully. Choose from Stromberg-Carlson's extensive line of quality-engineered, standard "building blocks," and obtain precisely the top quality sound installation you want—without unwanted "packaged" extras. And there's no need to fear system obsolescence with Stromberg-Carlson standardized components. Add additional features, additional stations at any later date with the same ease with which you built the initial equipment.

Two vital points. Stromberg-Carlson's rigid inspection and quality control assure you of minimum maintenance and service requirements. Stromberg-Carlson has by far the largest team of sound experts throughout the U.S., always ready to give you immediate and continuous personal attention.

For information and literature write:
Commercial Products Division,
1415-010 North Goodman Street,
Rochester 3, New York

* Wide choice of pre-amplifiers and amplifiers ranging from 3 to 250 watts output.
* Flexible Dial-X® Private Internal Telephone Communications which can be tied to your paging system.
* "Key-municator"—Loudspeaking Intercom System—beautifully styled for the executive desk.
* Pagemaster® Selective Wireless Paging System provides instant personal contact with the man on the go.
* A complete line of indoor and weatherproof outdoor paging, talk-back and hi-fi speakers.
* A variety of cabinet designs incorporate panels for phono, tape, radio switching, control and power.

STROMBERG-CARLSON
A DIVISION OF **GENERAL DYNAMICS**
For more facts circle 565 on Reply Card



These plants don't tolerate hot spots...

MARLEY COOLING TOWERS

convert them to profit spots

Major manufacturers who are building the new industrial south never permit water waste to reduce profits. In modern-to-the-minute, super-efficient facilities like those of the Kohler Co., producer of finest plumbing fixtures, and P. Lorillard Company, makers of Kent and Old Gold cigarettes, Marley cooling towers are always first choice for profitable water conservation.

At the home of Kent and Old Gold, Greensboro, N. C., two intermediate capacity Marley towers cool air conditioning equipment and a Marley industrial tower furnishes condensing water for power generating. At the Kohler pottery, Spartanburg, S. C., engineers specified five Marley towers; four serve zoned air conditioning and one cools a critical molding process.

For any type of service, of any capacity, there is a cooling tower in the comprehensive Marley line that will pinpoint the job. Since it saves 95% of gross water requirement, a Marley tower is an investment that quickly repays its low initial cost.

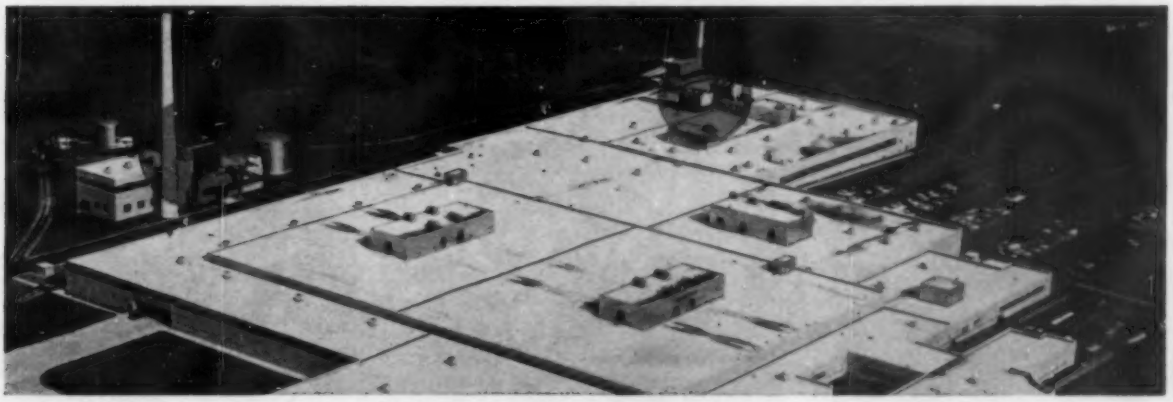
Get complete information from your Marley engineer (in 60 major cities) on potential saving a Marley tower can make in your plant. He will assist in surveying water waste from hot spots that can be changed to profit spots. Look for Marley in the yellow pages or write directly to

THE MARLEY COMPANY (MARLEY) **KANSAS CITY, MISSOURI**

"HOT SPOT" CHECK LIST

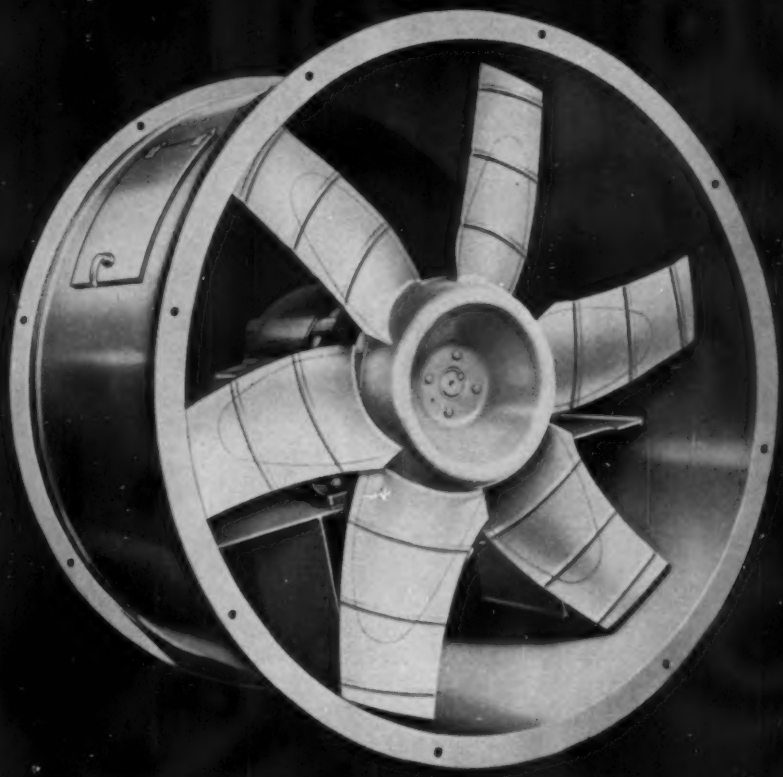
Are you wasting water in your plant because of—

1. **Air Conditioning?**
2. **Refrigeration?**
3. **Air compressors?**
4. **Molding presses?**
5. **Welding equipment?**
6. **Steam condensing?**
7. **Processing?**
8. **Furnace doors?**
9. **Quenching operations?**
10. **Any other plant service that requires 25 gpm or more?**



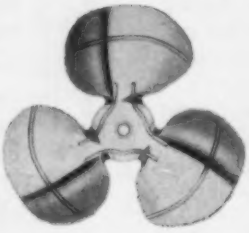
For more facts circle 566 on Reply Card

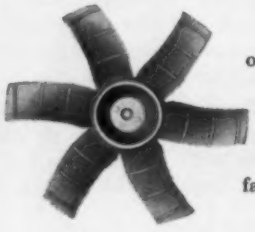
TRANE announces



Duct type propeller fan is a heavy-duty axial fan for moving clean or contaminated air. Installed anywhere in the duct system. Model B fan blades. Available in 16″, 20″, 24″, 30″, 36″, 42″ and 48″ sizes. Direct drive type for simplicity, economy—or with belt drive for flexibility. Totally enclosed motors.

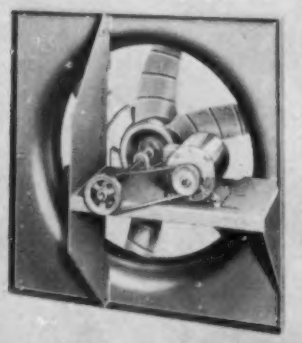
TYPE A BLADE is designed for general ventilation and exhaust. For low pressure applications. Features all-aluminum blades. 20, 25 and 30 degree blade angles for more versatile selection.





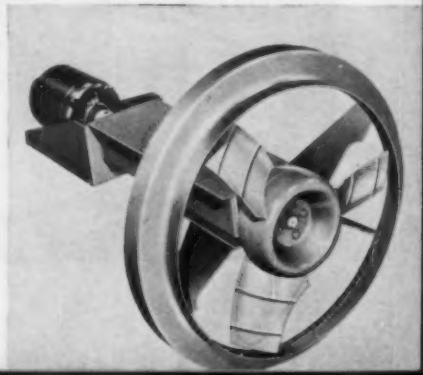
TYPE B BLADE is heavy-duty, to operate against pressures up to 1″. Large, spun-steel hubs. Main steel blades are electrically welded to a secondary steel blade. This makes for sturdy assembly, well equipped to withstand the stress of higher pressures. 3 or 6 bladed fan wheels; 10, 15, 20 or 24 degree angles.

TRANE panel fan may be mounted on walls, ceilings or partitions. Model B blades are available in 36″, 42″ and 48″ sizes—belt or direct drive. Model A blades available in 11¼″, 13¼″, 16¾″ and 19¾″—direct drive only. 25¼″ and 30″, in either belt or direct drive.



Orifice fan handles air through short duct runs; installed at duct inlet or outlet (or on wall). Model B blades; sizes: 16″, 20″, 24″, 30″, 36″, 42″ and 48″—belt or direct drive. The TRANE Orifice Fan is designed for a wide variety of both commercial and industrial applications.

Extended shaft fan is used where air or gas is handled at high temperatures; where air is very dirty or corrosive; to exhaust contaminated air. Model B blade type, direct drive, in 16″, 20″, 24″, 30″, 36″, 42″ and 48″ sizes.



—a new line of propeller fans with 266 standard combinations!

They're versatile. They're efficient. And they meet more air handling requirements—accurately!

Here is a big, complete line of propeller fans for industrial and commercial applications —from TRANE, leaders in fan design for over thirty years. These new axial flow fans will meet a wide variety of needs: dissipating fog over dye vats; exhausting fumes from pickling vats, welding smoke from fabrication areas; ventilating paint shops, chemical laboratories, oven rooms, factory and commercial offices, kitchens, laundries and other areas.

There are nine basic fan types in this new TRANE line; 2 blade types, seven blade angles; a total of 266 combinations with standard models to meet the most exacting specifications! And these propeller fans are economical: low in initial cost, low in operating cost. They're more efficient, too; capable of operating against higher resistant pressures. A major design feature on panel, orifice and extended shaft fans is the extended spun orifice ring that funnels air smoothly into the fan wheel to prevent turbulence, air leakage; assures a smooth air flow off the blades.

Developed in the TRANE "House of Weather Magic," these fans have been extensively tested in accordance with AMCA and ASHRAE standards. Sound tests, overspeed tests, pressure tests, have proven them dependable and rugged. And *every* fan wheel is given a running balance test to assure even, vibration-free performance.

WANT MORE FACTS? For specifications on the complete TRANE line of fans, just call your nearby TRANE Sales Office. Or write TRANE, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA.
CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO
100 U. S. AND 19 CANADIAN OFFICES

. . . there's a TRANE Fan for every job!

Axial roof ventilator provides economical ventilation for mills, factories, warehouses. Designed with lower silhouette, costs less to install and operate. 5 sizes. Models also for handling corrosive and explosive fumes and gases. Centrifugal roof ventilators also available.

TRANE industrial fans are available in 3 basic wheel types: A, for exhaust systems; B, for granule-conveying; S, for stringy material. 11 sizes, 11″ to 37″ inlet diameter; 5 arrangements to meet any process system need.

Class III fans are designed for high-pressure air conditioning systems, industrial processing and drying. 15 standard sizes from 18″ to 73″, for static pressures up to 11½″. Complete line of Class I and II fans also available.

Packaged utility fans are designed for supply and exhaust in hundreds of ventilation applications. Advanced design features assure exceptionally smooth and quiet operation, long life. Available in capacities to 15,450 cfm.

Apron Conveyors—excellent for horizontal or inclined conveying.

JEFFREY CONVEYORS TO MEET YOUR MATERIALS HANDLING NEEDS

COMPONENTS, ACCESSORIES FROM STOCK

The plant engineer must treat every conveying job as a brand new project; the material to be moved has its own peculiar characteristics; distances, elevations and surroundings vary to affect operating conditions. Selecting a conveyor requires a thorough knowledge of the factors involved.

That's where Jeffrey's 75 years of materials-handling experience steps in to help. Based on this know-how, our engineers recommend the type of conveyor that will move the material most efficiently. They help plan it for maximum performance at most economical first cost; will even supervise installations.

Jeffrey conveying equipment maintains high production, lightens labor's burden and reduces operating costs. Send for data. The Jeffrey Manufacturing Company, 905 North Fourth Street, Columbus 16, Ohio.

Vibrating Conveyors—transport hard-to-handle materials easily.

Spiral Conveyors and Bucket Elevators—team up for horizontal and vertical travel.

Belt Conveyors—move materials swiftly across country or on short hauls.

Bin Valves • Car Pullers • Chains • Idlers • Pulleys • Sprockets • Take-ups • Buckets • Pillow Blocks

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...

TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

For more facts circle 568 on Reply Card

For more facts circle 569 on Reply Card →

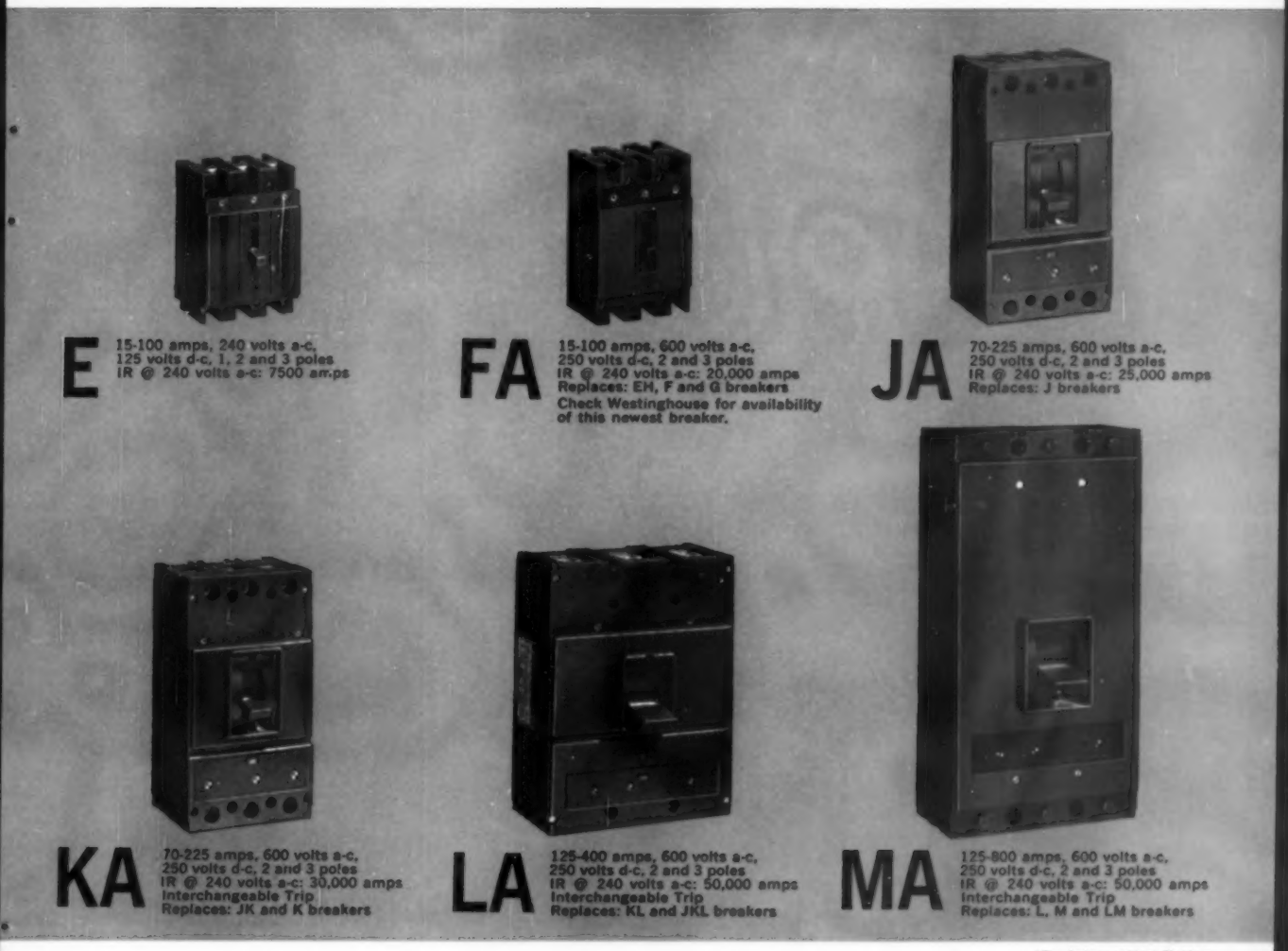
EH G g JK TJ TJK eh K F jk LM NF tef
NE NM TEF KL TKL LM EH TJ jkl EH k
K EH G JK TJK JK TEF NF Mm TKL eh
F JK LM NF Mm tef EH JKL G eh JK TJ
K EH tjk JK NF LM F G TJK Mm KL nm
TJK JKL TJ G jk TKL NJ KL JK EH tjk

in specifying AB breakers the reign of confusion is over

Westinghouse completely redesigns its breaker line

SIMPLE TO SPECIFY/EASY TO IDENTIFY

Newly designed breaker line simplifies frame designations . . . reduces space requirement up to 50%. Because of recent Westinghouse engineering advances, these new breakers retain the same high interrupting capacities of older designs in smaller frame sizes. The new designs mean it's easier for you to order, install and use AB breakers. Gone is the confusing assortment of letters that designate other models. These new breakers are easy to identify because they follow a common-sense sequence. They're simple to specify because you choose from only six breakers for virtually every application. They're better to use because they're smaller . . . yet you have the same quality and reliability of the former Westinghouse models you've been using.

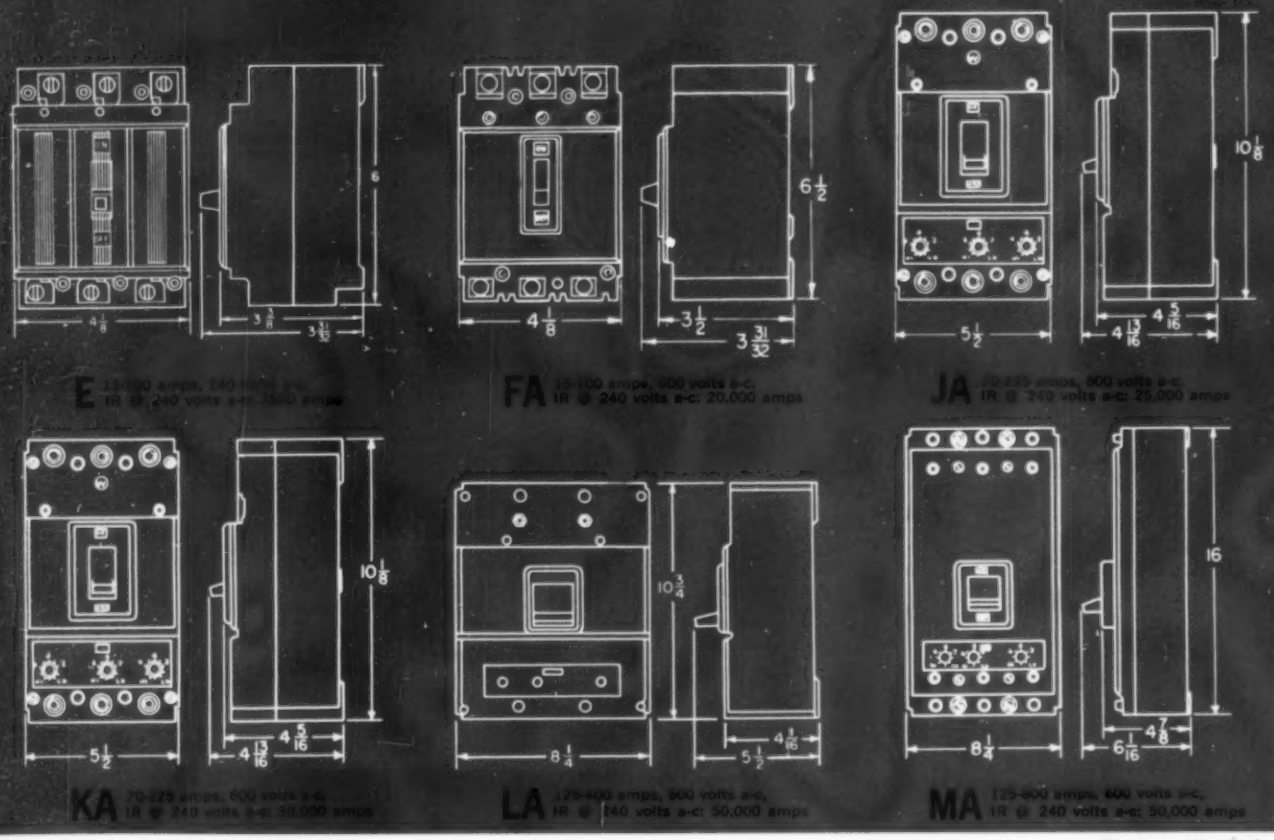

E
15-100 amps, 240 volts a-c,
125 volts d-c, 1, 2 and 3 poles
IR @ 240 volts a-c: 7500 amps
FA
15-100 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 20,000 amps
Replaces: EH, F and G breakers
Check Westinghouse for availability
of this newest breaker.
JA
70-225 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 25,000 amps
Replaces: J breakers
KA
70-225 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 30,000 amps
Interchangeable Trip
Replaces: JK and K breakers
LA
125-400 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 50,000 amps
Interchangeable Trip
Replaces: KL and JKL breakers
MA
125-800 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 50,000 amps
Interchangeable Trip
Replaces: L, M and LM breakers

IR = Interrupting Rating

• Add the fact that terminals accept either copper or aluminum cable. Any way you look at it, the **NEW** Westinghouse line is the one you'll want to use from now on. • Want more information on this new line of breakers? Contact your Westinghouse representative, Westinghouse distributor, nearest independent panelboard-switchboard builder, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. • We're offering a free wall chart that shows the new line of breakers. It measures 17 x 22 inches, is plastic coated and gives dimensions, interrupting ratings, maximum amps and volts and, of course, the newest designations along with the breaker photos. Write to the Westinghouse address above for your copy.

All Westinghouse AB breakers meet or exceed NEMA and UL specifications.

new breakers / new sizes / new designations



IR = Interrupting Rating

a Westinghouse breaker for every application

SAF-T-VUE* . . . lets you see whether the contacts are open or closed. Fills the needs of every industrial plant where safety codes require visible contacts. All frames.

MARK 75* . . . interrupts up to 75,000 amps at 240 volts a-c. Costs a fraction of conventional high interrupting capacity breakers. Does not require reactors or fuses, is particularly suited for network systems.

TRI-PAC* . . . smallest, lowest cost protective device you can apply where 100,000 amps can be poured into faults. Example: network systems or those fed by large transformers.

THERMAL MAGNETIC . . . provides instantaneous opening on short circuits, yet permits harmless momentary overloads such as those encountered in motor starting and initial lighting surges. On sustained overload, the higher the current, the shorter the opening time. All frames.

AMBIENT COMPENSATED . . . ends nuisance tripping, and eliminates need for derating where elevated or changing temperatures are encountered. All frames.

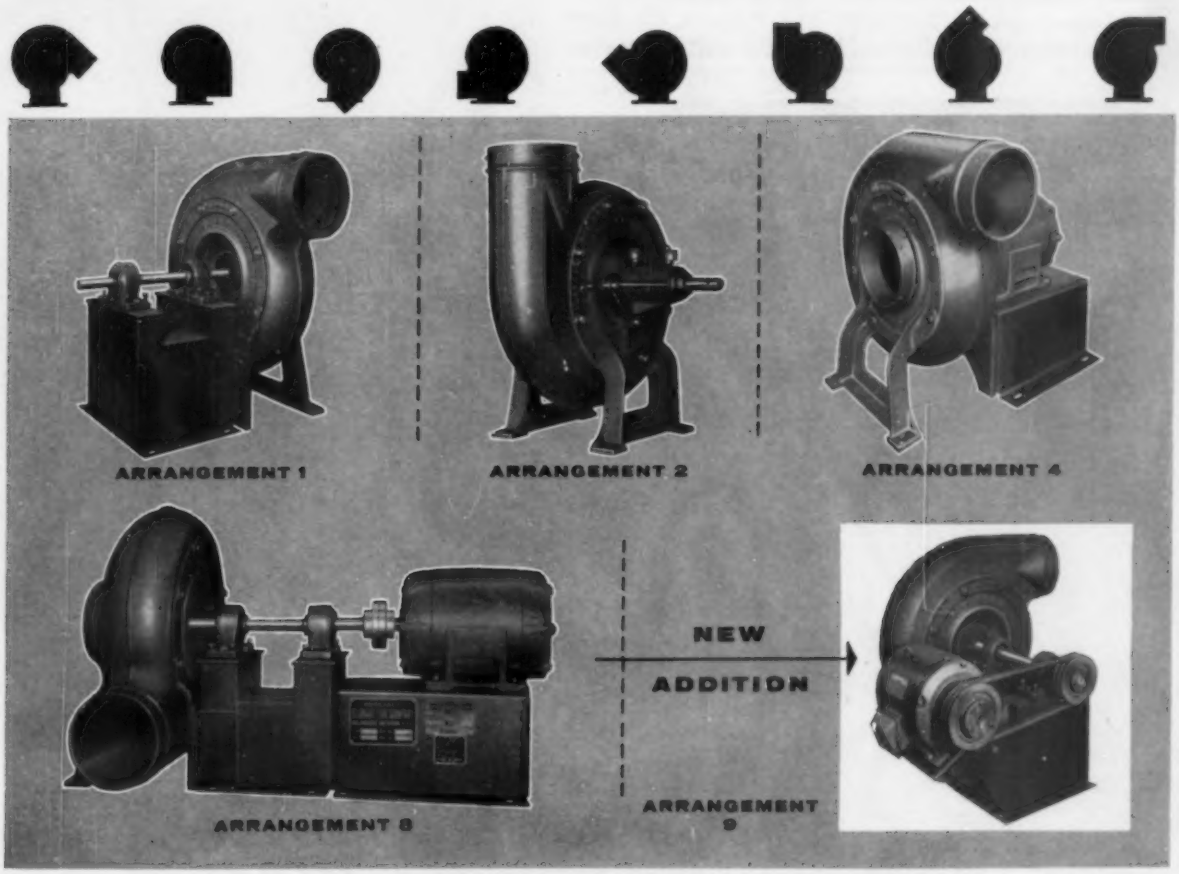
MAGNETIC ONLY . . . provides short circuit protection only. Primarily used on motor circuits where overload protection is provided by other means. All frame sizes except E.

WESTINGHOUSE ELECTRIC CORPORATION Standard Control Division, Beaver, Pa.

*Trade-Marks

Printed in U.S.A.

JI-30317



Presenting... *the new line of CLARAGE Type CI Exhausters*

Volumes to 3800 CFM, pressures to 18″, temperatures to 750°F., six sizes, three wheel types, five arrangements as shown above, adjustable to any of the eight standard air discharge directions.

Result: fan equipment uniquely well suited to nearly every service imaginable. The uncomplicated, heavy construction, featuring cast iron housings and sideplates, makes the Type CI the natural selection for such severe applications as exhausting from grinding, woodworking, and other machines . . . conveying materials ranging from fibers to grains . . . removing smoke and fumes . . . furnishing industrial process air . . . handling chemical and hot gases.

Write for new Catalog 707 containing performance tables, dimensions, and system data. Get acquainted with the advantages you'll enjoy by choosing Clarage Type CI Fans for your next requirements. CLARAGE FAN COMPANY, Kalamazoo, Michigan.

Dependable equipment for making air your servant

CLARAGE FAN COMPANY

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

For more facts circle 570 on Reply Card

SAVE MONEY ON TOUGH SERVICES WITH QUARTER-TURN LUBRICATED PLUG VALVES

You'll get a big bonus of longer life and bottle-tight shut-off with Rockwell-Nordstrom lubricated plug valves. Fully protected seats and dependable operation assured by lubrication mean superior performance on difficult services—pickling acids, caustics, slurries, etc. On other and easier services, you will also benefit, since Rockwell-Nordstrom valves cost no more than non-lubricated valves and in some instances less. They open or shut quickly with a quarter turn of the wrench.

There are literally hundreds of ways Rockwell measurement and control equipment is helping manufacturing and processing plants save time, money and materials. The experience of the world's largest single manufacturer of valves, meters, regulators and other equipment for measurement and control can pay off for you, too. Wherever liquids or gases flow through pipes in your plant there is a real opportunity for savings. It will cost you nothing to get the facts . . . Simply send the coupon.

ROCKWELL

The leading single source for Measurement / Control products and ideas

For more facts circle 571 on Reply Card

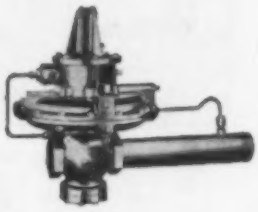
"IN-PLANT" METERING:

LIQUIDS AND GASES

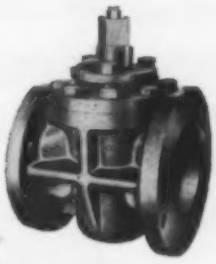
Rockwell gas and liquid meters, properly applied, can improve quality control, sharpen cost control, and prevent waste in almost every plant department. A Rockwell Field Engineer can help you find *where* meters will cut costs . . . and Rockwell has a complete line of meters to measure practically anything that will flow through pipe.

CONTROLLING PIPED MATERIAL:

LIQUIDS AND GASES



More efficient control of all the material flowing through pipes in your plant is a positive step in cutting costs. There are new applications and new ideas for using gas pressure regulators and valves that will stop wasteful, inefficient, and dangerous handling of fuels, production fluids, and products. A Rockwell Field Engineer can show you *where* and *how*.



HOW MUCH COULD YOU SAVE?

There is hardly a plant of any kind—including yours—where the right application of the right measurement and control methods and equipment won't produce savings many times the modest cost involved. It will cost you nothing to have a Rockwell Field Engineer *show* you. Simply send the coupon below, now.

SEND COUPON NOW!

MEASUREMENT AND CONTROL DEVICES

all fine products by

ROCKWELL

Rockwell Manufacturing Company, Dept. MC2K, Pittsburgh 6, Pa.

☐ Please have a Rockwell Field Engineer call me for an appointment.

Please send literature on ☐ Controlling gas pressures; ☐ Valving gases, liquids and slurries; ☐ Measuring liquids; ☐ Measuring gases.

I am concerned primarily with ☐ Light & Heavy Metal Fabricating ☐ Basic Chemical Production ☐ Chemical Processing ☐ Food, Drugs & Tobacco ☐ General Manufacturing Operations ☐ Petroleum Processing

☐ Others: _____

Name: _____ Title: _____

Company: _____

Address: _____

City: _____ Zone: ____ State: _____

You can't "breathe new life" into old unit heaters...

don't repair.....

1 Every heating season, thousands of old steam unit heaters develop leaks. And when a unit starts to leak it's almost a sure sign useful life is just about over. Repairs are usually a waste of time and money . . . it's economically wiser to replace.

2 In *time* alone, it costs from $25 to $300 (if scaffolding is required) to disconnect, take down and reinstall an "old-age" unit. Add the actual repairs — and the final cost is prohibitive. What's more, chances are additional leaks will soon crop up.

3 Unit heater failure is generally caused by internal or external corrosion. Sometimes it's due to improper venting or trapping. But even with careful maintenance, units eventually begin to show signs of wear, lose efficiency, develop leaks.

4 Because it's impossible to inspect the extent of corrosion within heating coil tubes, no one can predict where or when the next leak will occur. Repairs only prolong the unit's life for a *completely unpredictable* length of time.

In Canada: Sarco Canada, Ltd., Toronto 8, Ontario

. replace with Modine

5 Service records show that most unit heater failures occur during coldest weather . . . often interrupt production at critical times. With a well-planned replacement program, failures are anticipated . . . units can be replaced in summer and early fall.

6 By replacing your old units with new Modines, you eliminate the danger of shutdowns and the expense of frequent (often useless) repairs. And you'll find that new Modines heat better, use less fuel, run quieter and require only routine maintenance.

Get your Modines from local distributor stocks

POWER-THROW® . . . 10 SIZES

HORIZONTAL . . . 24 SIZES

VERTICAL . . . 28 SIZES

PROPELLER-TYPE GAS-FIRED . . . 8 SIZES

You'll find just what you need in Modine's unit heating equipment line. It's the world's broadest . . . with types, models and sizes to match any temperature, air delivery and location requirement. Most important, *all* Modines have these benefits in common: superb styling, long-life, economical installation and operation, just-right heating performance.

Find out how you can save by replacing your unit heaters with new Modines . . . either steam and hot water or gas-fired. Mail the coupon for full information.

COMPLETE REPLACEMENT PROGRAM DATA !

See your Modine distributor or use this coupon to get (1) full information on replacement program, (2) 22″ x 24″ wall chart containing unit heater maintenance tips and a valuable performance check list, (3) Modine's "Repair or Replace?" bulletin, (4) Gas Unit Heater Installation Guide.

Modine
MANUFACTURING COMPANY

MODINE MANUFACTURING CO.
1563 DeKoven Ave., Racine, Wisconsin

Send replacement program data ☐; wall chart and "Repair or Replace?" bulletin ☐; Gas Unit Heater Installation Guide ☐.

Name .....

Firm .....

Address .....

.....

SU-1398

For more facts circle 572 on Reply Card

Hall Industrial Water Report

VOLUME 8 OCTOBER 1960 NUMBER 5

How to Avoid Crash Programs

What caused your latest emergency crash program? Was water at the bottom of it? Did boiler tubes fail because of internal deposits or corrosion? Power plant down to clean turbine blades? Steam heat cut off for repair of leaking return lines? Air conditioning equipment shut down to clean condensers? Process gone sour due to poor clarification of water? In trouble with state authorities over contaminated waste water?

Crash programs to maintain production or to minimize losses caused by shutdowns for repairs or changes to improve water conditions are costly. They can be avoided if suitable water treating equipment is installed and effective water conditioning programs are adopted.

Hall Laboratories engineers are specialists. They can advise on equipment and set up water conditioning programs designed to give you trouble-free operation at low cost. And they can teach your operating men how to maintain the proper water conditions.

Stripper Column Deposits

During a routine boiler water conditioning service call at a New Jersey chemical plant Hall field engineer Frank Duesing spoke of plant-wide water service. Immediately, a plant chemical engineer suggested that Duesing look at a solvent recovery stripper column which was out of service because of heavy deposits on the bubble plates. The plant engineers had assumed that the deposits were composed of material picked up by the solvent and precipitated in the recovery equipment.

Duesing tested the deposit in dilute acid. The rapid evolution of carbon dioxide gas indicated that the material was made up largely of calcium carbonate. This meant that the hard raw water being used was responsible for the deposition. Duesing recommended acid cleaning of the column and substitution of zeolite-softened water, or preferably condensate, for the raw water. Zeolite-softened water was immediately available so this was used.

There has been no further deposition of calcium carbonate, although a little temporary trouble occurred when the solvent did become contaminated with catalyst. The previous experience led to quick identification of the material so that plant engineers could promptly stop the contamination.

Flood Causes Water Shortage

When floods produced a break in the dam of the municipal reservoir at a city in Ohio, all industrial city water users had to curtail consumption. A box company immediately made plans to keep their boiler operating by bringing water in tank trucks from a neighboring city. Unfortunately, there was no time to clean the tanks which had been transporting oil and salt water.

Hall field engineer Dale Holland arrived at the plant just before use of the contaminated water was started. After quickly analyzing the purchased water he set up a program of hourly testing, blowdown control and antifoam feed. He then helped the operators maintain good control during the emergency period. The quick action permitted trouble-free operation of the boiler despite oil contamination, harder water and abnormally high solids concentrations.

One of the plant operating men remarked that, in his opinion, no plant production would have been possible during the emergency without the help given by the Hall Laboratories engineer.

Deaerating Heater Trouble

Despite repeated recommendations of Hall field engineer Stan Ziarkowski to use sodium sulfite to protect the boilers from corrosion, the operators in an industrial plant did not get around to installing the necessary feeding equipment. There seemed to be no urgency because the boilers had operated for a long time without corrosion damage.

When Ziarkowski inspected the largest boiler, and found some pitting his concern grew. The situation was serious because this boiler was the only one which could carry the entire plant steam load. His concern increased when feedwater tests showed the concentration of dissolved oxygen to be much higher than normal for a deaerating heater.

The heater was inspected and cleaned. Nothing to account for poor deaeration could be found so it was put back in service. Again feedwater oxygen tests showed excessive concentrations. Another inspection was made at Ziarkowski's request and this time the vent condenser was opened. Here was the trouble. Many tubes were leaking, permitting water to pass through the heater without being thoroughly deaerated.

Vent condenser tubes were repaired. The use of sodium sulfite was started. Then all ran smoothly. What seemed to be an unnecessary move could have saved the replacement of more than one hundred fifty pitted boiler tubes and avoided production downtime.

Water is your industry's most important raw material. Use it wisely.

How Consultants Solve Industrial Water Problems

There are no "stock answers" to industrial water problems. A new 24-page booklet, "Hall Laboratories—Industrial Water Consultants," describes the many ways industry can use water most economically. For a copy of this booklet, write on your letterhead to:

HALL LABORATORIES
HAGAN CENTER, PITTSBURGH 30, PA.
Consultants on Procurement, Treatment, Use and Disposal of Industrial Water

DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
For more facts circle 573 on Reply Card

WHAT'S JUST AHEAD IN THIS ISSUE?

- CORROSION PROBLEMS in their inorganic finishing rooms led Western Electric's Merrimack Valley Plant to a study of materials which resist acid fumes. Result was a combination of PVC ductwork and hoods, and fiberglass-reinforced polyester ducts. The article starting on the next page tells you the result of this high-cost but cost-saving job.

- PORTABLE TOOL repair costs can be an expensive item in any plant budget—but they can be controlled. In the article beginning on page 118, the author tells how his company gets the most work possible per purchase dollar from its portable tools. It's done by adhering to a carefully worked out maintenance and repair program.

- IF YOUR MATERIALS HANDLING job requires only a hand truck for its most efficient operation, it doesn't seem reasonable that you would invest in a fleet of 10,000-lb fork lift trucks. Basically, that is the theme of the article starting on page 123. The author shows you how to analyze your own operation and how to apply some common-sense rules to equipment selection.

- NUMERICAL POSITIONING CONTROL may be the answer to the high cost of small-lot production—on drills, lathes, milling machines and even welders. To find out how it works, what it will do and how fast it will return your investment, turn to page 130.

- PROPER ROUTING of lubrication men throughout the plant is half the battle. Lockheed's Georgia Division is winning that battle with a system in which IBM cards are employed in scheduling the lube routes for the men. The article begins on page 140.

- VENDING MACHINES have come a long way from the peanut and chewing gum dispensers of years ago. Now a gleaming array of semi-human mechanical philanthropists dispense—for a price—practically every type of viand imaginable. Layouts for some highly successful coin-operated industrial plant restaurants are described in the article "Machines That Feed Men" on page 142.

- SELECTING a maintenance supervisor? Before you do check the article on page 158 to see if you are placing the right value on the 11 factors which our author considers important in making this selection. See how your rating system compares with this one.

PVC FOR DUCTWORK— IT COSTS MORE, BUT IT CUTS COSTS, TOO

By **GEORGE L. SCHMIDT, Senior Plant Engineer, Merrimack Valley Works, Western Electric Co., Inc.**

MANY CORROSIVE fumes can and do raise havoc with coated metal ducts. In order to eliminate many of the problems associated with plating rooms and similar locations, we decided on the installation of non-plasticized polyvinyl chloride for the ducts and piping in our Merrimack Valley plant's inorganic finishing room.

Normal-impact PVC ducts were used for exhausting corrosive fumes from our inorganic finishing room. Non-plasticized PVC, which is dark grey in color, was used since we considered the higher chemical and temperature resistance of this material of greater value in our application than high impact strength. The high-impact grade material, which is light grey in color, did not offer much advantage for overhead systems which are reasonably protected from damage.

Seven complete PVC duct systems were installed for exhausting fumes from neutralizing and acid dip tanks, copper and tin barrel plating tanks, zinc barrel plating tanks, precious metal tanks, a copper-tin automatic plater, a zinc automatic plater, and a bonderize and alkali etch unit.

Each system, consisting of horizontal runs at the first floor ceiling and vertical risers to fans on roof, averaged about 135 ft in length and about 24 in. by 28 in. in cross section. The ducts were fabricated in the supplier's shop and assembled in the field. Field cutting and welding was kept to a minimum.

Runs were fairly complex with a number of elbows and offsets to avoid installation interferences. Figures 1 and 2 are typical views of the installations. A difficulty experienced immediately after the installation was the sagging of the top of the ducts on the roof where they were exposed to the sun. This was corrected by installing additional PVC stiffening braces. Also, in several cases, it was necessary to increase the number of PVC bolts on flanged horizontal connections to eliminate leaks from condensation in the ducts. In future installations we plan to use stainless steel bolts in the lower sections of the flanged joints, since they can be drawn up tighter without shearing.

Cost of the material and installation, not including exhaust fans, hoods or engineering design was $5.84 per pound or $2.94 per square foot of duct material. We estimate that the PVC duct installa-

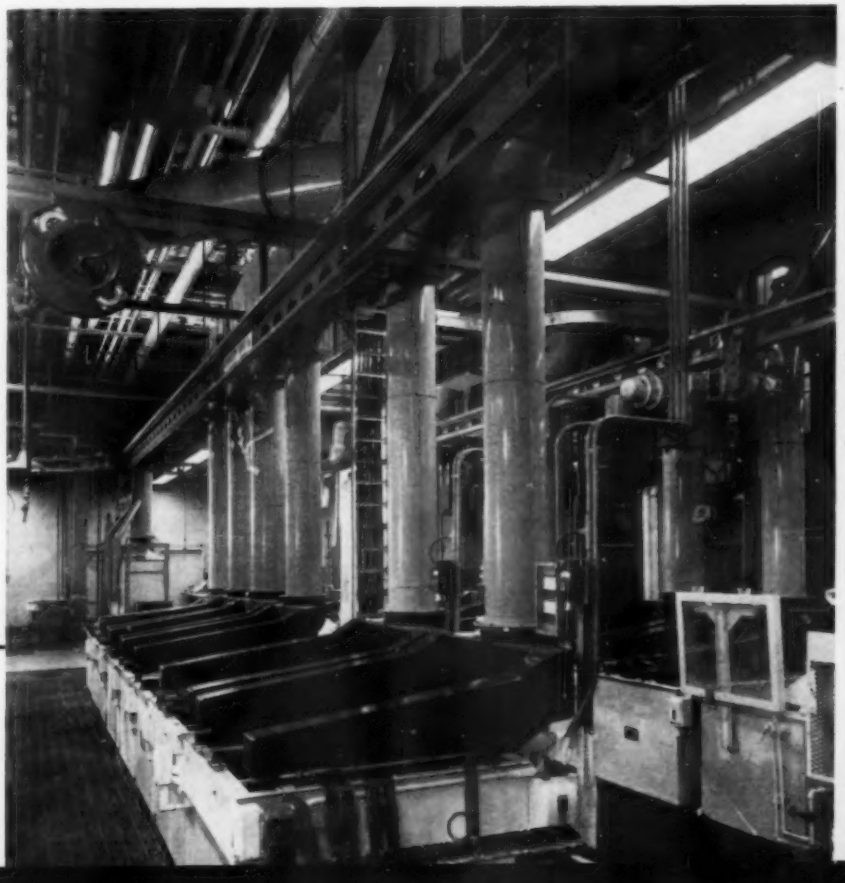


Fig. 1. General view of one of the seven complete PVC duct systems in finishing rooms at Merrimack Valley.

Fig. 2. Another general view shows horizontal duct runs.

Fig. 3. Fans, motors are installed on steel platforms on roof.

tions for this project cost about 75 per cent more than an installation of coated sheet metal, but felt that the initial high cost was justified.

A survey of other Western Electric plants indicated that the average life of coated metal ducts was about two years.

Three different types of exhaust hoods were used on the various plating tanks. Where there was a possibility of the hood being hit and damaged, plastisol coated metal or stainless steel was used; otherwise hoods were fabricated from PVC.

Fans, Motors Installed on Roof

Fans and motors are installed on a steel platform on the roof as shown in Fig. 3. The roof is of the poured gypsum type and adjacent to and paralleling the platform is a section of gypsum planks where ducts pass through the roof. This permits easy cutting for duct holes or patching if they are removed. Where duct systems pass through the second floor concrete slab, stainless steel fire dampers are installed in the slab.

The fans are lined with ⅛ in. thick natural rubber except for one fan which was fabricated from PVC. This was for the purpose of comparative checks on service and maintenance cost. After three years of use the ducts, the PVC fan and the rubber-coated fans appear to be in as good shape as when put in.

Weather caps were not installed at the discharge end of the ducts in order to project the fumes as high as possible into the air and away from the air intakes to the building ventilating system. Fan motors are the totally enclosed type. Fans are belt driven and the drives are provided with weather protecting guards. Fan housings have a small opening in the bottom to drain out rain and condensation.

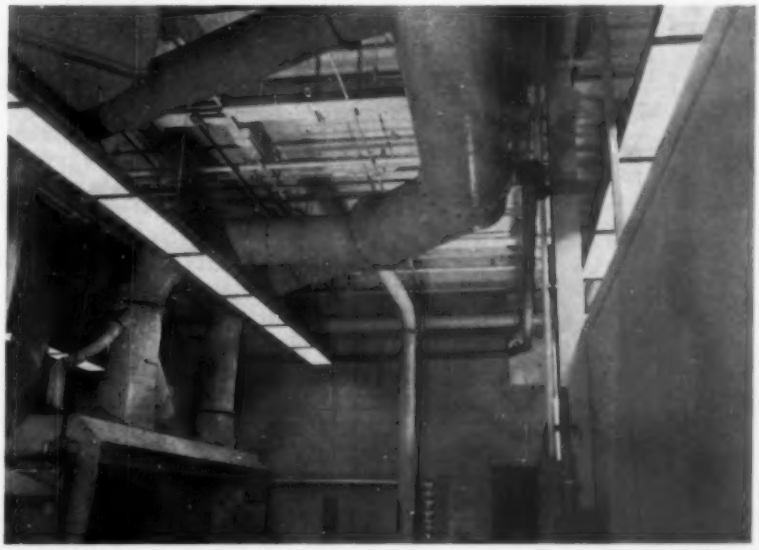


Fig. 4. This system was made of fiberglass-reinforced polyester. Corrosive fumes from resin flux and temperatures beyond the range of PVC were contributing factors that made it necessary to use this variation in two exhaust systems.

Two installations of fiberglass-reinforced polyester ducts were made. One of these, shown in Fig. 4 was for exhausting a solder dip position where the duct was subject to the corrosive fumes of resin flux and the temperature was beyond the limit of PVC. The horizontal runs and vertical risers are approximately 125 ft long and 27 in. in diameter. Fabricated cost of the duct was $3.80 per square foot not including installation and design. A second installation of polyester duct was installed to exhaust hot fumes from a baking operation involving a synthetic wax, which breaks down under heat, giving off corrosive chlorine gas.

PVC sinks, drain lines and exhaust hoods were installed in the Quartz Crystal Shop where small quantities of hydrofluoric acid are used. Also in this shop, a 2-in. PVC pipe line was installed for the deionized water system. Some difficulty was experienced with leaks developing in this line. Ambient temperature changes at the ceiling of an annealing furnace area where the pipe was installed caused excessive expansion but the difficulty was corrected by an expansion loop. **End**

Key to CONTROL AND MAINTENANCE OF PORTABLE TOOLS

1. Selection
2. Purchasing
3. Controls and accurate record keeping
4. Qualified repair supervision
5. Correct testing during and after repair
6. Cooperation between production and maintenance
7. Compliance with safety codes

By **WALTER JACOBY, Sup't., Maintenance & Construction, Special Products Division, I-T-E Circuit Breaker Co., Philadelphia, Pa.**

PORTABLE TOOL repairs in large industrial operations can readily climb from a controlled $200 a month to an astonishing $2000 a month, unless an effective control and maintenance program is used.

Ultimate tool efficiency starts with selection and purchasing, progresses through distribution and use, to repair and control techniques.

As far as selection is concerned, the tool that requires the least maintenance is the most desirable choice. Maintenance history files show that the better tools are more economical in the long run. For instance, renewal parts should be reversible and interchangeable wherever possible. Tool housings that are split provide for ease in replacing cracked and broken parts. Bearing inserts should be steel, allowing bearing changes to be made without difficulty.

In our company, portable tools are received by the maintenance department. From the shipping paper, the purchase order number provides it with the key to the department which ordered the tool. After receiving the tool, an I-T-E number is stencilled on it, a four-pin polarized plug is installed, a case history card is placed in the machinery maintenance file, and the tool is turned over to the respective production department.

Once in production, the next contact with the tool comes from breakdown repair request, and this is where maintenance control procedure really works. The procedure is as follows:

1. The portable tool repair requisition, referred to as the tag, is employed as the means of communicating the description of, and the authority for, the work to be performed between the initiating department and the maintenance department.

The tag is a printed requisition, divided into four tear-off parts provided to record the stages of the repair from requisitioning to completion. See Fig. 2.

A stock of requisition tags is maintained and issued to line supervisors upon request. Authorization signatures are obtained from supervisors only.

2. The tag is used to describe and authorize the performance of work, limited to the following classes of tools:

Portable hand tools—all classes of pneumatic and electric hand tools, such as grinders, sanders, chippers, hammers, riveters, spray-guns, and portable tank heads.

Machine tool attachments and accessories such as chucks, die heads, tapping heads, grinding attachments and tool holders.

Air hoses, water hoses, and extension cords.

Hand welding torches, acetylene, oxygen, argon gages, etc.

3. A tag can be initialed by any supervisor or group leader whose work requires such action.

On the tool repair tag part only, the following information is written:

I-T-E tool number, when applicable

Description of fault

Requisitioning department number

Department location by building, and bay number

Date of preparation

Authorization signature

The authorizing supervisor dispatches a messenger, with the entire tag intact who attaches it to the tool by the wire provided with the tag. The messenger delivers the tagged tool to the maintenance stockroom clerk.

4. The stockroom clerk fills in and signs the departmental receipt, and gives it to the messenger for return to the authorizing foreman.

The clerk tears off and fills in the stockroom receipt and places it on the portable tool dispatch board, see Fig. 1.

The clerk then fills in the tool repair order part of the tag, and turns it over to the foreman of timekeepers.

Work order cards are prepared and processed by the timekeeper as are repair requests.

The timekeeper clips the tool repair order to the work order card, gives it to the repairman at the time the man rings in on the job.

Stockman gives the tool to the repairman and clips the tool repair order to the working column of the tool dispatch board.

Tool repairs that cannot be completed are so indicated by the tool repair order being stowed in the holdover column of the tool dispatch board.

Stockroom receipts for jobs not worked on are stowed in the ready column of the tool dispatch board.

At the end of each shift, the stock clerk delivers all completed tool repair order tags to the foreman of timekeepers, who, in turn, stamps the tool repair order tag "complete" and mails it to the requisitioner.

Requisitioner dispatches messenger with departmental receipt to withdraw completed tool repair.

The messenger submits the departmental receipt in return for signing the stockroom receipt and withdraws the tool.

5. Holdovers are tools which have been worked on, but on which the repair has been stopped because of lack of material, or by order of the maintenance foreman.

6. Immediate requisitioning of tool repairs on a daily basis is of prime importance in the guarantee of efficient tool repair. The effort to attend to repairs on a daily basis further prevents bottlenecks due to the retention of faulty tools in production departments, and repair backlogs in the maintenance department.

Portable tools at I-T-E consist of two classes, pneumatic and electric. The first requisite of any machine is adequate utility services in order that it produce rated torque and horsepower. For pneumatic tools, adequate air supply, and dry air are necessary if they are to continue to perform at rated capacity.

A load survey consisting of the entire pneumatic load, from which a demand factor is established, determines the size of the air-compressor. An intercooler and aftercooler, a water chiller, a water trap, and separator are absolutely necessary. The heat of compression raises the dew point temperature of the air-vapor mixture, and moisture must be removed continuously by air cooling and subsequent disposal.

Air mains should be run with slight downward pitch, so that any condensate runs to the end of the main and into a drain leg, where a trap and separator automatically drain the line. All branch feed and drops should run out of the top of the main and pitch downward to aid proper drainage. Trap piping should

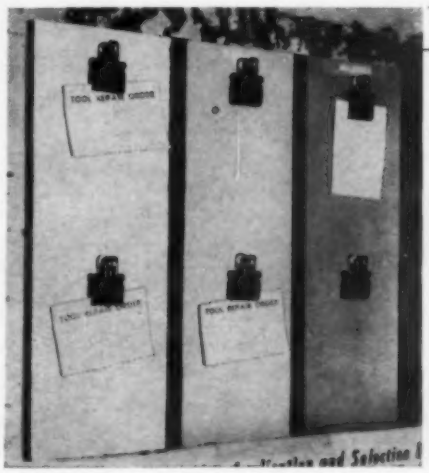


Fig. 1, left. Portable tool dispatch board makes it possible to keep track of repair to tools.

Fig. 2, above. Printed requisition is divided into tear-off parts, each of which records the stage of repair to each portable tool.

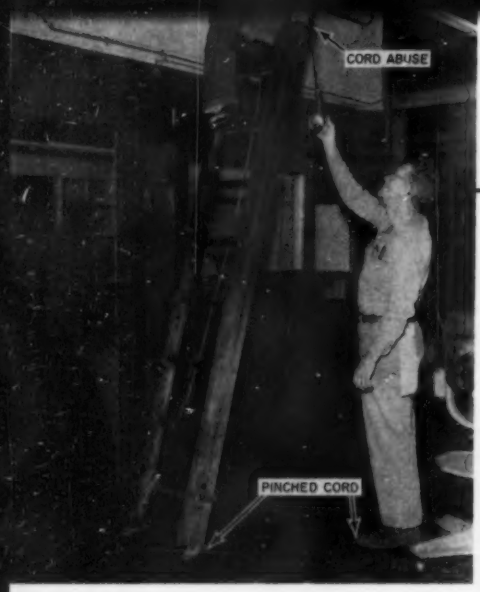


Fig. 3. Tools should not be abused. Cord should not be pinched nor should it be expected to support weight of tool.

TOOL CONTROL

be avoided and where encountered, a trap and separator should be installed for moisture removal. Piping from compressor to points of use must be arranged to isolate and remove water at each transition from main to sub-main to branches and drops.

Referring to Fig. 4, notice the sample air main resting on top of the test panel. The correct and incorrect method of air run-outs is shown. The tee on the right is at the bottom of the main, where it will collect any moisture in the line and feed to a tool. The hose, which would serve a pneumatic tool, is pinched and restricts air flow. In time, this hose will leak and the main will have to be shut off to make repairs, as the hose tee is not valved.

The run-out method to the left of the sample is on top, valved, and a return bend gives a straight and plumb hose terminal.

The best automatic line oiler and filter will not overcome the disastrous effect of moisture on pneumatic equipment.

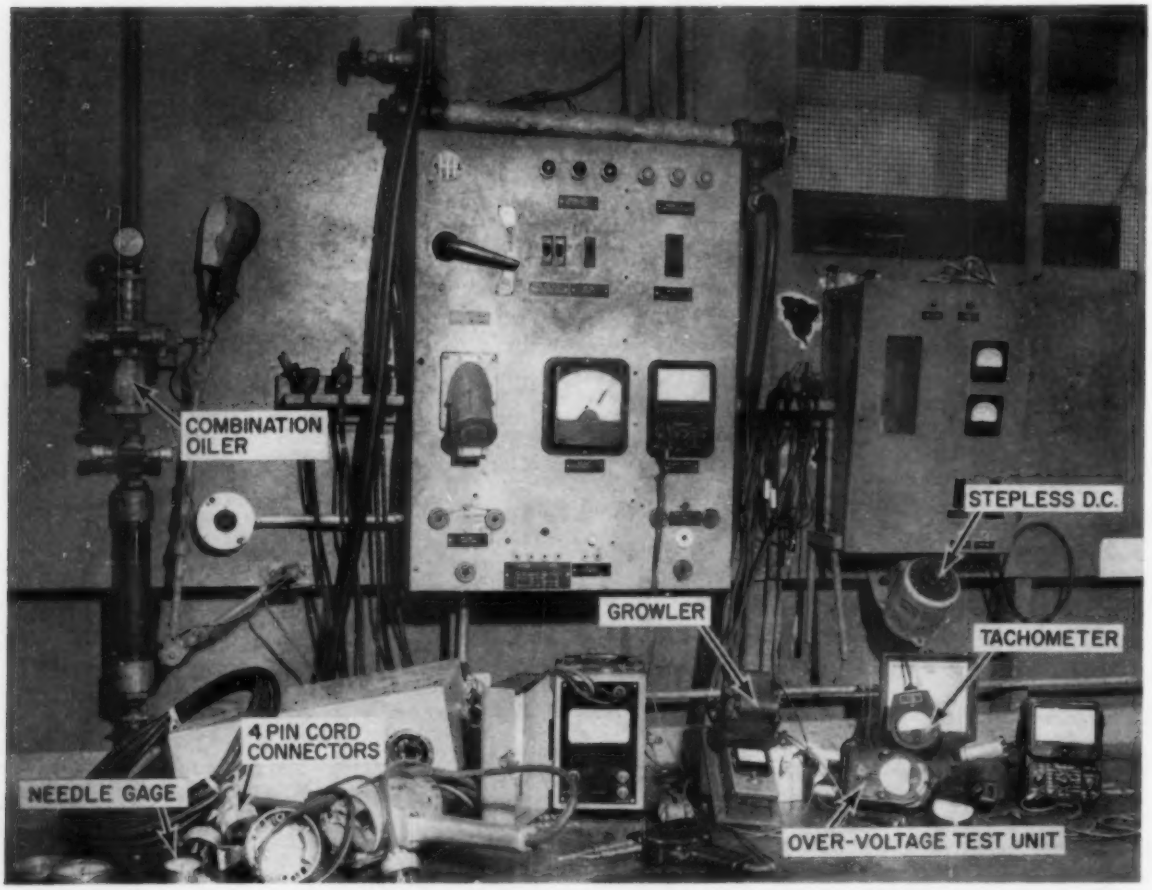
Figure 4 indicates application of a combination oiler and filter that is standard at all fixed air outlets. Manufacturers' recommendations should be followed in selecting correct lubricants for rotating or percussion tools. Transparent bowls leave no room for excuses when an oiler runs dry.

Water tends to wash the lubricant out of the tool, and must be eliminated. If the compressor is not equipped with an aftercooler, mains should be pitched toward the receiver properly trapped for automatic moisture removal. Dirty traps do not work effectively, so a cleaning schedule is important.

Air lines should be sized to deliver at least 90 psi at the outlet, under load.

A needle pressure gage, also shown in Fig. 4, is a handy service tool. Pressure can be checked at the

Fig. 4. Portable tool and small motor repair bench and test equipment. All items are good investment for tool repair shop.



tool by injecting the needle into the hose line at the tool. Tool pressure while running should never drop below 80 psi. A compressor pressure of 100 psi with load pressures of less than 80 psi points to corroded piping, restrictions that do not allow sufficient air delivery, or faulty valves and hose fittings, etc.

Electrical tools, too, must have rated line pressure while running. Under load, the voltage at the tool should not drop below 10 per cent of rated voltage. Low voltage under load indicates inadequate power service due to insufficient transformer capacity, or too small or too long distribution lines. It is important to properly derate wire for ambient temperature, and allow for voltage drop due to length of runs.

Figure 4 shows the small motor and portable tool repair bench in the maintenance department. The electrical test panel provides 440 v, 3 phase; 208/115 v, 3 phase; 115/230 v, single phase; 125 v, d. c., power and light ground lamps; four, 24-v test plugs; an integral mounted volt-ohmeter and a stepless d.c. power supply.

Equipment used external to the panel is shown on the bench. This includes an internal and external growler, clamp-on ammeters, voltmeter, contact temperature indicator, tachometer, and an over-voltage test unit. Tools are tested at twice the operating voltage + 1000.

Air outlet with grade regulator, pressure gage, and combination filter/oiler are shown with a quick-change, plug-in valve for air tools.

A dynamometer for measuring load performance of all portable tools and small motors is in the planning stage.

Compliance with recognized safety practices is compulsory to insure proper use of tools and provide protection for operators. The first rule in observing portable tool safety is to repair all cracked or broken tools. Faulty tools should be immediately removed from production.

Grinders, either pneumatic or electric, are potential safety hazards. With the exception of cone-shaped wheels, all wheels should be operated under guards. Wheel and arbor bores and diameters should match. Wheel washers and collars should fit properly to grip the wheel firmly.

Slow-speed wheels, which are vitrified bonded and not run over 5500 to 6500 sfpm depending on the bore, and high-speed organic bonded wheels operating at 6500 to 9500 sfpm, shoul never be run in excess of rated speed. Usually, a circular blotter around the arbor hole indicates the type of wheel and permissible speed.

Cracked wheels can be tested by placing one finger loosely through the bore, and lightly tapping the wheel with a wooden hammer handle. A true clear ring indicates that the wheel is not cracked.

Wheels can be tested safely by running the wheel inside a five gallon bucket, a precaution that might avoid a serious injury.[1]

Figure 3 shows the usual abuse to air hoses, extension cords, and tool cords. Here, a helper is receiving the tool, but usually, the tool is lowered to the floor, and sometimes this will result in a damaged tool.

The frame of all portable tools should be grounded in an approved manner. Two-pin caps with a green colored pig-tail are not the positive ground interlock that provides maximum automatic ground protection.

Approved methods of grounding are shown in Fig. 5. At I-T-E, 115/230 v, single phase distribution is used, providing for dual voltage connections and load balancing at the tool caps. This accounts for the 4-pole receptacles, connector bodies, and caps. Since the equipment ground pin is the longest pin, it is the first to make contact, placing the tool frame at zero voltage, or ground potential, before the tool can be energized.

Tools when received by Maintenance, are equipped with four-pin, polarized, twist lock caps, before distribution.

Cord adaptors to transpose from 3 to 4 pole, 2 to 3 pole, and vice-versa can be hazards that destroy positive grounding practice. **End**

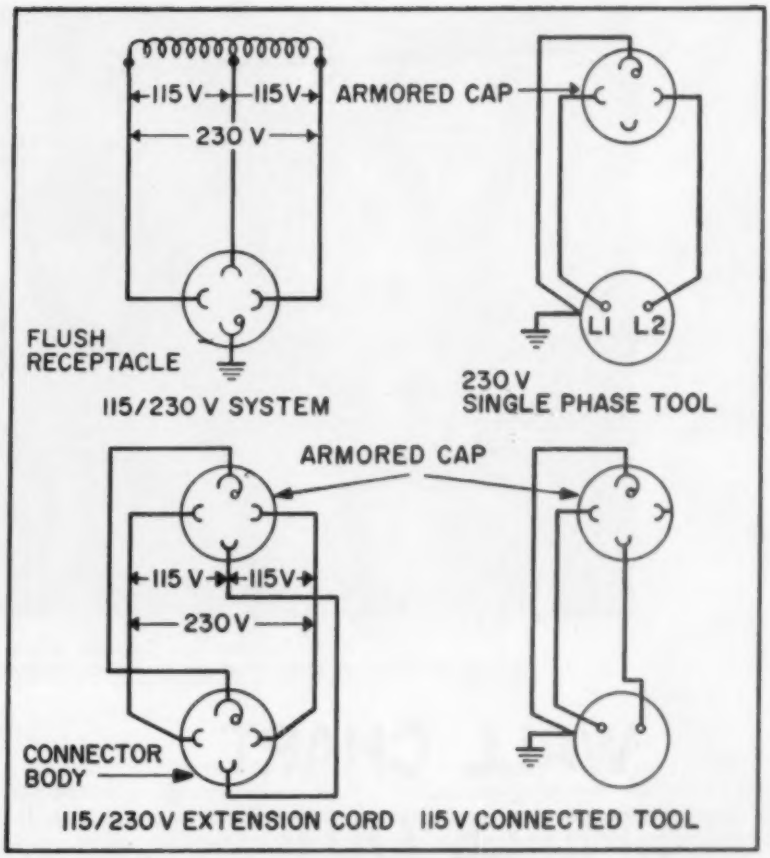
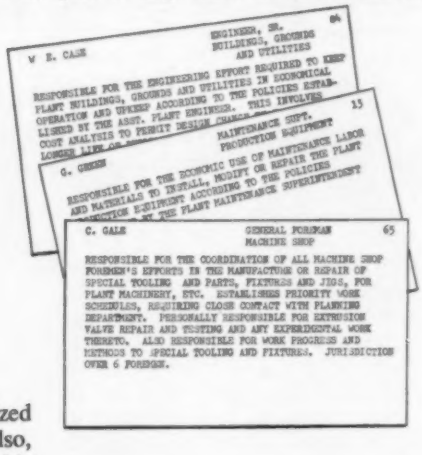


Fig. 5. Recommended methods of safe grounding for portable tools used in a 115/230 v system: 230 v single phase tool; 115/230 v extension cord; 115 v tool.

[1]The Grinding Wheel Manufacturers Association issue "American Standard Safety Code for Abrasive Wheels." Care, mounting, handling, and operation of all wheels are extensively covered in this publication.

Plant Engineer Don Cravener points to one of job responsibility cards. Samples of instructions on the cards which are part of large chart are shown below.

WALL CHART SPELLS OUT SUPERVISORY RESPONSIBILITIES



W. E. CALE — ENGINEER, SR. — BUILDINGS, GROUNDS AND UTILITIES — 64

RESPONSIBLE FOR THE ENGINEERING EFFORT REQUIRED TO KEEP PLANT BUILDINGS, GROUNDS AND UTILITIES IN ECONOMICAL OPERATION AND UPKEEP ACCORDING TO THE POLICIES ESTAB-LISHED BY THE ASST. PLANT ENGINEER. THIS INVOLVES COST ANALYSIS TO PERMIT DESIGN CHANGES [illegible] LONGER LIFE OR [illegible]

G. GREEN — MAINTENANCE SUPT. — PRODUCTION EQUIPMENT — 25

RESPONSIBLE FOR THE ECONOMIC USE OF MAINTENANCE LABOR AND MATERIALS TO INSTALL, MODIFY OR REPAIR THE PLANT PRODUCTION EQUIPMENT ACCORDING TO THE POLICIES [illegible] BY THE PLANT MAINTENANCE SUPERINTENDENT

C. GALE — GENERAL FOREMAN MACHINE SHOP — 65

RESPONSIBLE FOR THE COORDINATION OF ALL MACHINE SHOP FOREMEN'S EFFORTS IN THE MANUFACTURE OR REPAIR OF SPECIAL TOOLING AND PARTS, FIXTURES AND JIGS, FOR PLANT MACHINERY, ETC. ESTABLISHES PRIORITY WORK SCHEDULES, REQUIRING CLOSE CONTACT WITH PLANNING DEPARTMENT. PERSONALLY RESPONSIBLE FOR EXTRUSION VALVE REPAIR AND TESTING AND ANY EXPERIMENTAL WORK THERETO. ALSO RESPONSIBLE FOR WORK PROGRESS AND METHODS TO SPECIAL TOOLING AND FIXTURES. JURISDICTION OVER 6 FOREMEN.

AN ORGANIZATIONAL chart of mural proportions has proved a valuable asset to all members of the engineering staff of the Reynolds Metals Company extrusion plant in Phoenix, Arizona.

Originally constructed for the personal use of Plant Engineer Don Cravener, the chart has proved a good way to clarify the structure of the departmental organization for all its members.

Basically, the department is divided into two groups. One section consists of all engineering and design functions. The second section consists of all maintenance functions dealing with Mechanical, Electrical, Machine and Die Shops, and General Labor and Transportation areas.

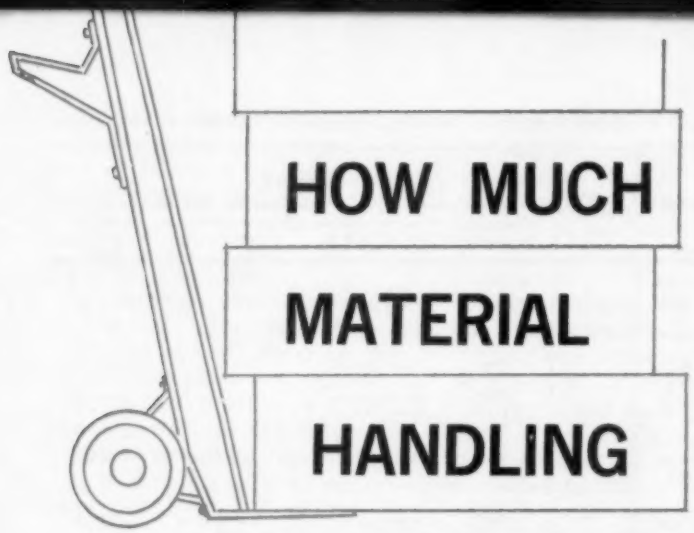
It is essential that each and every member of these groups knows how his efforts are to be utilized in coordination with others. Also, he must be thoroughly aware of his area of responsibility and accountability as well as lines of authority.

The first step in consummating this plan was to draw up the customary supervisory organization chart. Following this, "job descriptions" or proper identification of the duties of the individuals, were established. This "job description" was approached in the conventional manner by defining extent of, and limitations, in booklet form.

In the process of relating "job description" to the organization chart, it became apparent that a simple, direct correlation would be desirable. This thinking led to the development of a spacious organization chart, which would permit showing lines of authority and be large enough to include job description in the "boxes."

Some advantageous usages of the 8- by 5-ft chart are quite obvious; for example, during interview of a prospective employee—he may see for himself exactly where he fits into the "picture,"—when counselling an employee, his individual position with respect to others may be illustrated, as well as discussed.

Obviously the size of the organization involved would be a factor in the desirability of this approach. The organization covered by this chart includes approximately 90 supervisory personnel with various degrees of responsibility. They supervise over 500 hourly employees. **End**



DO YOU REALLY NEED?

"How much?"—of what kind—is a vexing problem for the engineer who is not an MH specialist. The author shows how to approach the problem logically

By HERBERT L. TYGESSON, Manager, Materials Handling Division, The American Pulley Company, Philadelphia, Pa.

HOW MUCH MATERIAL handling you need is not necessarily answered by multiplying the basic material handling unit by some constant. If a conveyor fits your needs, the answer to how much is "One". Or, you may need five portable elevating trucks, two skid and pallet trucks and one large fork lift truck —the well known "combinations of active ingredients that do not upset" the flow of material.

What is needed to start with is an approach which will make some sense out of the 90-odd different types of conveyors, elevators, cranes, hoists, tractors, trailers, trucks and miscellaneous motor transports. There have been many methods and techniques advanced for the analysis of material handling equipment. Most approaches can be categorized into one of the following:

1. Movement study of the parts;
2. Cost of lost production due to employees waiting for material handling equipment; and
3. Cost of moving a unit package through a unit distance, or a cost of handling index for pieces of equipment.

Each of these approaches has its own particular drawback which, I feel, makes them of limited value to anyone except material handling engineers. They are of little use in the small and medium plant where materials handling is a part-time function of one engineer.

Basing material handling needs on the zigs and zags of a part from raw material through production, inspecting, packaging and shipping is vulnerable to changes in part design, part obsolescence and production improvements. The flow of parts changes with all these conditions. For example, the industrial engineer might decide to change the sequence of operations on a particular part. A study based on the original sequence is chucked right out the window.

Waiting line theory is just that—a theory. In actual practice, the cost of waiting does not drop off in a nice smooth curve with increased material handling capacity. As material handling capacity is added, there is a marked decrease in what production personnel will handle. Their attitude is reflected by "We have a piece of equipment to handle this, let's wait until it is available". And, marginal jobs that previously may have been handled by manual labor now become jobs for the material handling equipment.

As a result, the nice smooth cost-of-waiting curve becomes a rough saw-toothed affair that is extremely difficult to pinpoint and apply to existing conditions with any degree of certainty.

Cost-of-handling index needs an extremely accurate time and motion study. Such an index includes amount of material to be moved, distances and route. Even after you have the index figure for each different type of equipment, there are over thirty different conditions that affect the accuracy of the answer. If production level changes, creating fluctuation in the amount of material to be moved, you get an entirely different set of index numbers for each piece of equipment.

Basically, these approaches are not flexible enough. They do not allow proper consideration of integrating various types of material handling equipment. Further, they cannot keep up with rapid changes in production schedules and production techniques.

What is needed then is some approach that (within reason) determines the need for material handling equipment and that is relatively insulated from these other problems. We need some system that will not

HOW MUCH MATERIAL HANDLING?

be obsoleted by rapid changes in production schedules or manufacturing techniques.

For any particular set of circumstances there is, obviously, one best way to move the load over a given area and raise it to a certain height. As the conditions change, so does the best method. If we can group similar conditions — geographically within the plant—then we should be able to select the proper equipment.

This is not such a theoretical approach as it may first appear. Actually, similar operations do group themselves naturally, and these operations are relatively independent of fluctuations in schedules and changes in production techniques. The majority of similar material handling jobs fall into three well defined groups—shipping and receiving, warehousing and manufacturing.

There is a well established engineering principle that roughly translated says "What goes in must come out". If you receive one or two truck loads of material each month, this will probably coincide with a comparable volume of shipping. The means of shipping and receiving will probably coincide. If you receive supplies by rail, the chances are you ship by rail. If you receive by truck, you probably ship by truck. If you receive a stream of raw material that enters your plant on a belt conveyor, the shipping must also be a steady stream of boxes, cartons or bags. Therefore, some sort of conveyorized system would be applicable to shipping.

Plant layout is subjected to very little fluctuation. If warehousing is 100 ft from the receiving platform today, it is a good bet that it will be there tomorrow and next year, *even if the material being received is different*. Changes that are made in warehousing, generally, move it closer to shipping, receiving or manufacturing. So, what you might lose on one end of the operation will be gained at the other end.

Manufacturing facilities change rather slowly. If your plant is equipped with several batteries of automatic bar machines, turret lathes and automatic screw machines, regardless of what changes in production routing are made, the parts will still be made on the same machines. It just isn't the nature of business to be making ceramic tile one day, missile parts the next and pop-up toasters the following.

Table I shows the types of material handling equipment for pallet or skid loads.

Type of Equipment	Expense Ratings*	Limitations			
		Single Lift (in pounds)	Frequency of Loads (No. of Trailers)	Frequency of Moves (Moves per Day)	Length of Movement in feet
Manual:					
Skid and Pallet[1]	1	2000 to 6000	1 to 2 per mo.	Up to 30	0 to 100
Portable Elevator:					
Manual Lift	2	1000	5 per mo. max.	Up to 30	0 to 100
Power Lift	3	2000	5 per mo. max.	Up to 30	0 to 100
Powered:					
Portable Elevator and Fifth Wheel Power Lift	4	2000	1 per day	Up to 40-50	100-300
Heavy Duty Walkie	5	2000	4 to 5 per day	Up to 150-200	100-300
Light Weight Rider Model Fork Lift	6	2000	5 to 10 per day[2]	Up to 300	300 up
Fork Lift Heavy Duty	7	4000+[4]	5 to 15 per day[2]	Up to 300	300 up

*1 is least expensive; 7 most expensive. [1]Horizontal movement only.
[2]Depending on length of move. [4]Two or more pallet loads high.

Shipping and Receiving

The first problem with receiving or shipping is getting the truck or rail car loaded or unloaded as quickly as possible to avoid demurrage charges. What is in the truck will in a great way determine what type of material handling equipment is going to be needed. It is also important to consider the frequency of truck or rail car arrival.

Is the material received in small, medium or large individual packages or in larger unitized loads such as skids or pallets? Let's consider unitized loads first. There is nothing complex about it. The simple economics should prevail, i.e., what is the least expensive way to get the job done? Some sort of material handling equipment must be used since unitized loads are too big to be lifted manually.

Least expensive material handling equipment for pallet or skid loads is manual skid and pallet or portable elevator trucks. These trucks are limited as to range—0 to 100 ft. See Table I. Manual equipment should be used if only a few trailer loads are received or shipped a month. There is no problem as to which type. If stacking is required—a portable elevator. If stacking is not required—a skid or pallet truck.

Smallest and least expensive powered equipment are portable elevating trucks with a fifth wheel power attachment. These units are suited for more than occasional heavy loads as long as the pallets size is in the 1500-lb class. These units are quite adequate for unloading the average trailer with a 15-ton load as long as the round trip does not exceed 400 ft. These units will also stack the load where desired. Although a job like this would take about 1½ hours, portable elevating trucks with fifth wheel drives are not rated for continual use under this type of loading. Therefore, only about one trailer load per day could be handled in this manner.

Heavy-duty walkie-stackers are available for full-day work. These units are considerably more expensive. The speed of heavy-duty walkies is almost double the fifth wheel powered unit, but their range is not too much greater. Although they can range further as far as power is concerned, trips longer than 300 ft each way are more efficiently accomplished by rider-type equipment.

Now, what about non-unitized loads? Since they are not palletized, this means someone is going to have to lift them. This places a limitation

of 60 lb per individual package that can be handled on either a conveyor or a platform truck. Both of these require lifting and placing operations at each end of the trip. Conveyors need two men—one feeding and one taking away.

Two-wheeled hand trucks require no lifting, only a tilting, to get the load on and off the truck. Hand trucks are rated for capacities as high as 1500 lb for heavy crates and such. In any case, it becomes inefficient to move loads by hand truck if the length of the movement is over 100 ft.

One of the best ways to handle the non-unitized load is to unitize it onto pallets or into bins. The bins or pallets can then be handled according to the criteria established for unitized loads.

Warehousing or Storage

Don't confuse warehousing with shipping or receiving. Whereas the material handling equipment selected for receiving depends on the need to get trailers unloaded or loaded in a hurry, equipment selected for warehousing should be selected to make optimum use of storage. There is generally a big difference in the duty cycle between material being brought into warehousing and that going out.

There is almost always a need for tiered storage. Even though equipment selected for receiving or shipping is non-stacking, stacking equipment should be seriously considered for warehousing. How do your loads come into and go out of warehousing? Is warehousing just a stopoff point between receiving and manufacturing? Do the unitized loads coming from receiving go to manufacturing or do you have to break these loads down and make up new loads?

If you make up new loads rather than move the original unitized load, the smaller, more flexible and less expensive material handling equipment should receive your consideration. Portable elevating trucks, skid or pallet trucks save almost 50 per cent on aisle space by permitting aisles as small as 4 to 6 ft rather than the 10 to 12 ft required by the larger equipment. This saved space can be used for additional storage.

Watch the floor load! This is probably of greater importance in warehousing than in any of the other operations. When the operation is in an older, multi-story building, load carrying ability of the floor is of utmost concern. Check the freight elevator capacity as certified by the insurance inspector.

Load carrying capacity of wood floors is more difficult to determine. The best advice on this score is to bring in a consultant to inspect your building. Consultants are available in most metropolitan areas. It is not very expensive to have the floors surveyed and their load carrying capacity determined.

Outrigger and straddle type equipment must be used when you have floors with light capacities. Counterbalance or cantilever type equipment cannot be used under these conditions. The reasons are readily apparent, and it makes no difference whether the unit is a rider or a walkie model. Counterbalanced equipment must weigh much more than the load you are going to move. Typical counterbalanced equipment with 1500-lb capacity weighs approximately 4000 lb. This concentrates a total weight of almost three tons on the wheel area of the lift truck.

Outrigger and straddle type equipment do not counterbalance the load. Instead, the load is lifted within the base of the machine. The weight of our largest Safeway elevating truck plus a fifth wheel drive is only 850 lb. The combined weight of the truck plus the load is only a little over one ton.

Selecting the right kind and quantity of material handling equipment to service manufacturing areas in generally more complex. Most of the problems involved in shipping and receiving are also encountered in manufacturing. In addition, one or two new problems are added. You must consider 1. inter-departmental moves; 2. intra-departmental moves and 3. transfer areas which can be either inter or intra-departmental. We can eliminate high stacking equipment from consideration as high tiering equipment is seldom used. Frequently, you stack one or two high but no more.

Range of travel limitations applied to shipping and receiving apply to manufacturing operations. Plants with considerable distances from warehousing to the manufacturing area require heavy-duty powered equipment. Intra-department movement can be accomplished with manual equipment while movement to-and-from transfer areas might be accomplished by either manual or powered equipment, depending on distance and frequency. Small plants with warehousing close to manufacturing can be serviced by manual or fifth-wheel powered portable elevators.

Flexibility, availability and frequency of moves are the important factors in manufacturing. You don't have to move 15 tons of material a distance of 100 ft and stack it in a pile in a short time. Manufacturing requires one bin or rack of finished parts to be moved away and a new bin or rack of unfinished parts moved in. The new material may be sitting in the aisle or at another machine or in the transfer areas. The move may be only 10 or 15 ft. The load may weigh only

Table II shows types of material handling equipment for non-unitized loads.

Equipment Type	Single Lift in pounds	Total Load in pounds	Frequency of Loads (No. of Trailers)	Frequency of Moves (Moves per Hour)	Length of Movement in feet
Conveyor	60	—	1 to 2 per day[1]	250	100
Two-Wheel Hand Truck	1500	1500	Infrequent	100	100
Platform Truck	60	2000	Infrequent	5 to 10 moves per hour at 1000 to 2000 lb per load. Up to 90 moves with smaller loads	100-300
Unitizing the load by binning or by palletizing	—	2000	Infrequent	9 to 10 including binning and palletizing 40 to 50 if material is binned or palletized	(see unitized load table)

[1]This will require two men full time.

HOW MUCH MATERIAL HANDLING?

a few hundred pounds, and may be unitized or non-unitized.

Efficiency of the material handling operation is only a very minor consideration. Material handling is not an end in itself as it is in shipping and receiving. The important thing is to make production as efficient as possible. One way to make maximum use of production facilities is to provide everyone with his own piece of material handling equipment. This is slightly impractical and some alternate approach should be sought.

The closest approach to providing everyone with his own piece of material handling equipment is a conveyor system. Conveyors will handle the greatest frequency of moves and are available 100 per cent of the time. There is never a case that someone else is using the conveyor and a worker must wait for material handling equipment to remove or bring him some work. The frequency of moves depends on the speed of the worker. A continuous flow of light products between two fixed points is the ideal condition for conveyorized material handling. Although conveyors handle the greatest frequency of moves, they are not flexible.

Flexibility With Hand Trucks

Greatest flexibility is obtained from two-wheel hand trucks. They cost little. They handle heavy loads. Two-wheel hand trucks are valuable for short moves between machines or for moving completed jobs out to the main aisle for pickup and transfer by larger pieces of material handling equipment. There is no waste time for lifting and placing with two-wheel hand trucks. They are limited in that all moves are horizontal and they are restricted in handling unitized loads.

Platform trucks are less flexible than hand trucks and considerable time is consumed in lifting and placing loads on and off the platform. Individual lifts by one person are limited to 60 lb. Platform truck cannot be used to move stacked items without unstacking and restacking. As a result, this type truck finds little use in intra-departmental movements. Although they do find use in inter-departmental moves, double lifting and stacking makes for inefficient handling.

Intra-department movement of unitized or grouped loads should be handled by skid or pallet trucks, manual or power-lift portable elevating trucks or fifth-wheel powered portable elevator trucks.

It is possible to utilize heavy-duty material handling equipment for positioning the work at individual machines by special layout of production department. Few businesses can afford the 10 to 12 ft aisles which are necessary between machines within a department. A compromise can be worked out by running heavy-duty equipment "dead-ended" into narrower aisles for pickup and delivery. No room for maneuvering is available and the loads must be moved into position in the aisle by some other method. This technique requires a good deal of care in sequencing the pickups and drops.

There is little difference in the frequency of movement, availability or flexibility for any of the powered equipment used for unitized loads in intra-departmental movements. Top speed is 40 to 50 moves per hour. Flexibility is probably the major difference. Skid and pallet trucks are, naturally, limited to horizontal movement. Portable elevators can lift, stack and position. Lifting and positioning is slightly faster with portable elevators since powered equipment is available. Where departments or drop areas are close enough together, powered portable elevator equipment can also be used for inter-department transfer.

How Much?

To determine the best material handling equipment for inter-departmental movement, we go right back to the information necessary to determine the best equipment for shipping and receiving—frequency of loads and length of movement. Manual equipment can handle up to 30 inter-departmental moves a day as long as the moves are less than 200 ft round trip. Above this distance or volume, powered equipment should be selected.

Always use the least expensive method of getting the job done. Select the piece of material handling equipment best suited to the frequency of loads and length of movement within an area. Don't make the mistake of buying two or three smaller and less expensive units to do the job of one larger unit. What you save in original equipment costs will soon be absorbed by wages to the extra operators. Within an area, with a larger load, use a larger piece of equipment.

Large or Small Unit?

The converse of this principle is also true. Don't buy one large unit when you need several small units. This is especially true in manufacturing. When you are trying to make more moves per hour—not move greater loads—then specify several smaller units. As the moves get shorter and shorter, the speed advantage of the larger units diminishes and the flexibility and maneuverability of smaller equipment becomes more important. Don't be misled by the figures under "Frequency of Moves." (Tables I and II.) These figures are based on maximum single lift and average length of movement. The frequency of moves increases as either single lift weight or average distance moved decreases. When they both decrease, frequency of moves increases even more rapidly.

There is a limiting factor of 40 to 50 moves per hour with any type of grouped loads. Even this figure is ideal. The number of actual moves is reduced still more if the loads are the least bit shaky or wobbly. Any department or area requiring more than 20 to 30 moves per hour will, effectively, tie up a piece of equipment.

You can determine how much material handling equipment you need by separating your particular material handling activities into three areas—shipping and receiving, warehousing and manufacturing. Within each area, count the number of moves, the quantity of material to be moved and measure the average distance of the moves. From Tables I or II for unitized or non-unitized, respectively, select the material handling equipment that best fits these requirements. **End**

SMART SWITCH WAITS, WARNS ACTS

WE ARE INCLINED to look upon larger machinery as being rugged and well able to take care of itself. Compressors, generators and the like simply do not look delicate or damage-prone. However, as we all know, such is decidedly not the case; these machines are easily damaged—and when they do break down, and the defect is not caught at once, the expensive repairs take considerable time. In the case of many machines, the downtime itself is often expensive. This is usually due to the need for obtaining stand-by equipment to assume the load of the out-of-action machinery.

Acutely aware of the expense involved when major equipment breaks down, engineers at the U.S. Steel plant in Clairton, Pa., equipped their new in-plant oxygen compressor with all types of malfunction detection equipment. This, in addition to fully automating its operation.

The in-plant oxygen generation system at this huge, high-grade steel plant is the first of its type anywhere. The compressor, the largest high-pressure, multi-cylinder compressor in use, is a four-stage, four-cylinder, horizontally opposed unit driven by a 2,000 hp, 450 rpm direct drive electric motor.

One of the devices used to protect this compressor is Vibraswitch, a vibratory malfunction detector manufactured by the Aeronautical & Instrument Division of Robertshaw-Fulton Controls Co. This protective device is a fully mechanical, passive, relay-like device which is sensitive to all types of vibration: displacement, acceleration and velocity, and demonstrates increased sensitivity to higher frequencies of vibration than it does to lower frequencies.

In order to protect the compressor, four such units were mounted on the side of the compressor opposite each main cylinder assembly. By this positioning, maximum sensitivity is achieved. This was proven on two different occasions. On one occasion a small bead of weld from inside an intake pipe fell into a cylinder. The bead rattling around inside the cylinder soon scratched it.

Switch Prevented Major Repair

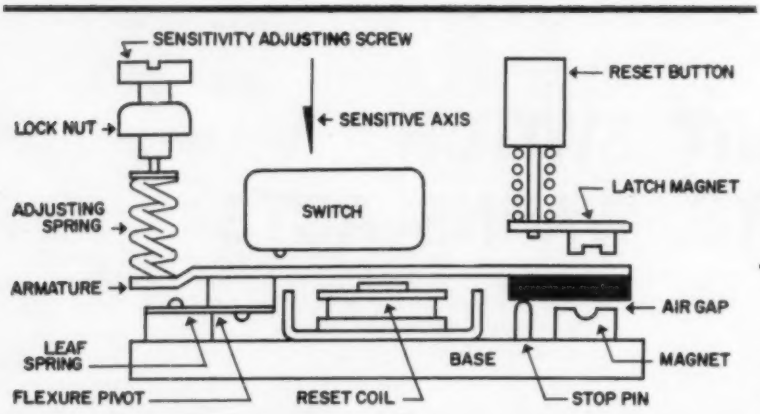
The resulting very slight, low amplitude, high-frequency increase in the acceleration characteristics of the normal compressor vibration was instantly detected by the Vibraswitch associated with that cylinder, and the compressor was immediately shutdown. Thus, instead of a major cylinder repair job, with the compressor down for an extended period, a more simple buffing job on the inside of the cylinder wall was accomplished.

In another instance, an oil feeder to one of the pistons failed, causing a dry piston condition and slight piston seizure. This again changed the acceleration characteristics of the compressor, and the switch associated with the piston shut the compressor down. Again, a major repair job was avoided. In fact, the only repairs needed were to the oil feed, none at all to the piston or cylinder wall.

The device that makes all this early warning possible is very much like a relay in design. See the sketch. It consists of a movable armature with one end between two permanent magnets, the other end under spring pressure, pivoted on a flexure pivot composed of two blocks in shear, one on either side of the spring-like armature, with a snap action electrical switch bearing against the mid-point of the armature. The armature rests against a pin projecting from the base of the unit when it is in its "untripped" position. Holding it in this position is the lower of the two magnets. A slight air gap between the weighted end of the armature and the lower magnet allows the armature to move with vibration.

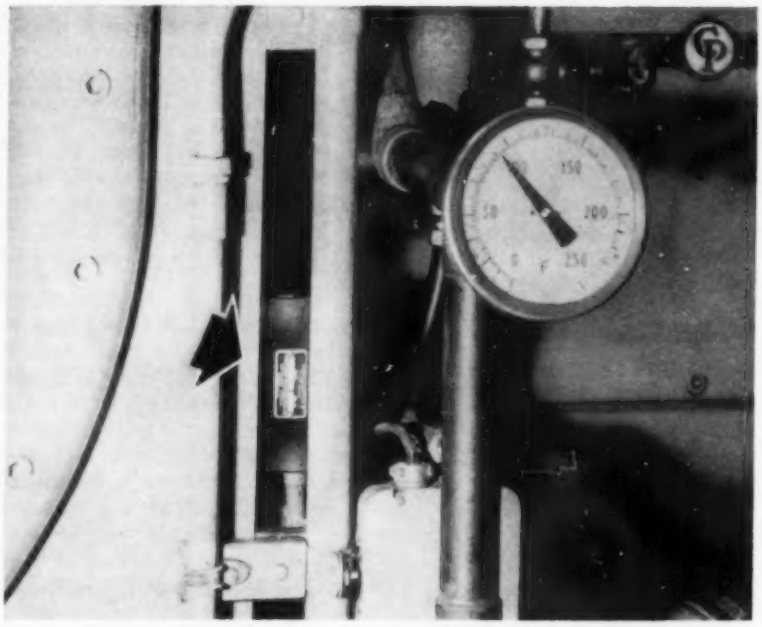
The spring which bears against the end of the armature opposite the magnets is adjustable to partially overcome the pull of the lower magnet. Thus, it is the sensitivity adjustment of the detector

Looking between the compressor cylinder and one of the interstage receivers. Small black oblong on wall, circled in color, is the malfunction detector.



Left: Sketch showing internal construction of the malfunction detector. Text describes operation of detector.

Below: Detector in place. When tripped, either the reset coil or the reset button may be used to return the armature to the untripped position.



SMART SWITCH

that determines the tripping point of the device.

When the vibratory forces act upon the base of the unit, the armature moves slightly, but is held in its untripped position because of the pull of the lower magnet and the inertia of the weight. However, once the vibratory forces overcome the magnet and the inertia of the weight, the moving inertia of the weight will keep the armature moving until it strikes the upper, or "latch" magnet. This magnet holds the device in the "tripped" position. While moving upwards to its tripped position, the armature operates the snap switch.

All electrical connections to external control or alarm circuits are made through the snap switch. The working portion itself is fully-mechanical.

Once the unit has been tripped, and it is desired to reset the device, a reset button on the top can be pushed, returning the armature to the rest position. Alternatively, in newer models, an electric coil in the lower part of the unit can be used to attract the armature to it, resetting the device.

This resetting coil can also be used to hold the armature in the untripped position during start-up periods, when normal vibration is usually exceeded.

In addition, when connected to a control unit, a time delay can be built into the device so that momentary pulses of high vibration will not trip the device. Thus, in some installations, air pockets, surges, etc., will not cause a shutdown. In these cases, the time delay unit holds the armature in its untripped condition for a pre-determined time after its first trip. If, after this time, the armature still trips, shutdown is initiated.

Because of the construction of the flexure pivot and the armature, the device is significantly more sensitive to higher frequencies of vibration. Low-amplitude, high-frequency vibration, such as that characteristic of failing bearings, metal fracture, cracked pistons, fractured crankshafts, dry bearing parts, foreign particles in moving parts, etc., are detected more rapidly.

In addition to its frequency sensitivity, a vibratory malfunction detector of this seismic inertial type exhibits high velocity and acceleration sensitivity. It will react to increased vibratory acceleration and velocity of vibration as well as physical displacement of the vibrating part.

This will enable the detection of out-of-balance conditions on rotating parts and off-normal load conditions, either of which will change both the velocity with which the vibrating part reverses direction and the acceleration with which this change is accomplished.

Because the class of vibratory malfunction detector represented by this unit has this manifold sensitivity to such a variety of symptoms of malfunction, they often are able to detect the malfunction before any significant damage is done. **End**

STANDARDIZATION REDUCES UNIT HEATER MAINTENANCE COSTS

By ROY HAHN, Maintenance Department, John F. Queeny Plant, Monsanto Chemical Company

WE HAVE REDUCED our unit heater maintenance cost 40 per cent by the use of standardized equipment and installation methods. This saving can be duplicated in many other large industrial plants.

Our original problem was a familiar one. Unit heater maintenance cost was extremely high. With over 600 steam-fired unit heaters in operation, any appreciable cost reduction per unit would total up to a substantial saving. Jurisdictional problems and haphazard installation methods made repairs or replacements time-consuming, expensive, and frustrating.

Heaters were hung, piped, and wired up as each individual doing that phase of the work saw fit. This led to a variety of installations. There were 10 different manufacturers' units in twice as many different sizes. Every conceivable type was in use: motors in voltages of 110, 220 and 440; explosion-proof; totally enclosed; capacitor and starting windings.

Unit Heaters Standardized

After a careful look at this situation, it was decided first to standardize on sturdy, lightweight units in three sizes that would meet the majority of our needs. In the past, many of the units had cast-iron headers which made them heavy and awkward to handle. A lighter unit was needed that would still handle steam pressures up to 110 lb. The heaviest of our standard unit heaters weighs 89 lb. All are equipped with 110 volt, totally enclosed, permanent, slip capacitor motors. In some rare cases an explosion-proof motor must be used.

Next, a standard hanger was designed that simplifies repairs and replacements. This is accomplished by using a 1⅝-in. 12 gage Unistrut section and ½-in. drop-forged eye bolts. Two of the eye bolts are cut open at the shank to form hooks that will receive the loop of two other eye bolts attached to the heater. See Fig. 1. This arrangement makes removal easy. We merely unhook the unit and lower it when repairs are necessary.

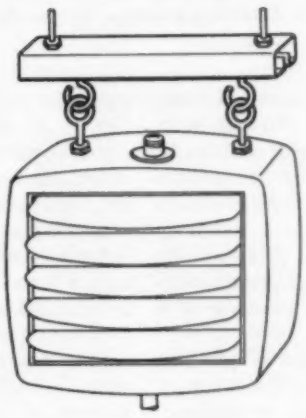


Fig. 1. Standard hanger was devised to simplify unit heater installations.

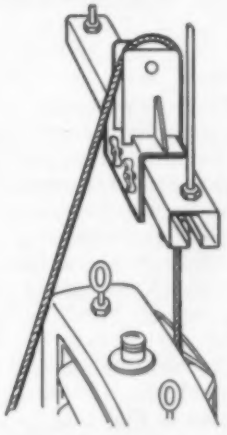


Fig. 2. This device was also designed for raising and lowering unit heater.

Prior to the standardization program some of the hangers were ⅝-in. rod, 20 ft long, threaded directly into the heater and tied into the overhead steel. Removing the heater was a cumbersome job, and when the rods rusted to the heater it became a real problem. Each time a unit was replaced a new hanger had to be made.

The hanger as it is now designed eliminates these problems. It will accommodate any of the three standard heaters without alteration.

To carry the program a step further a sheave was designed to clamp over the Unistrut and lock in place by means of two bolts with wingnuts. A ½-in. handline is used with the sheave to raise and lower the heater. See Fig. 2. One man pulls the rope with the unit

(Continued on page 282)

Fig. 3. View of one of the standardized heaters as it is installed in the plant.

UNDERSTANDING NPC NUMERICAL POSITIONING CONTROL

By J. A. BAKER, Specialty Control Department,
General Electric Company, Waynesboro, Virginia

WHAT IS numerical positioning control? To say what it is, we can list its main physical units consisting of a data input unit, the control unit itself, and the machine being controlled. In other words, with numerical positioning control, we use simple numbers as machine instructions to produce a part automatically. Any explanation further than this gets into the area of results. So we will say "what" numerical positioning control (NPC) is, by giving an example of it in action.

Let us start with a very ordinary type of job and carry it all the way through to the completed part. Illustrated in Fig. 1 is the part we want to produce. It is a mounting foot, made of aluminum and our job is a straightforward drilling operation. Accuracy has been specified at plus or minus 0.005 in. and the quantity is 60 parts.

Using conventional methods, we would probably start out by making a drill jig. A jig was actually made for this part in our tool room in 17 hours. In this part, four different drill sizes are specified in addition to the center drill. This is a natural application for a multi-spindle drilling machine.

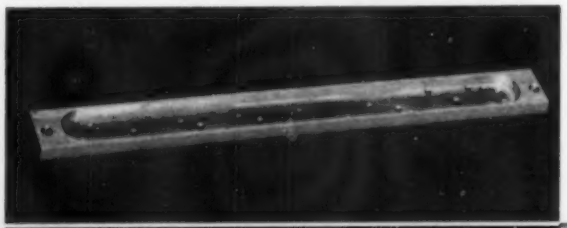
By following the line of conventional manufacturing procedure we have placed ourselves in a position to be faced with at least two familiar problems. These are design changes and re-runs or renewal parts made at a later date.

The jig is an investment, both in time and money, but it is rather inflexible. A design change may come through and obsolete the jig entirely. In any case, you must store the jig and take care that it is not damaged or lost.

Quite the contary is true when numerical control is used, for one of its greatest strengths is flexibility. Design changes can be easily made by merely making changes to the tape. Storage of tape programs require only a minimum of space. As an example, 500 programs can be stored in a tub file, occupying about two cubic feet. This contrast is shown by a comparison, Fig. 2, of our tape program and the jig required for the mounting foot.

Up until a few years ago, the use of a jig had been the accepted way of doing business. Today, using numerical control you do not need the jig and can forget about tool room schedules and costs. On top of this, a time study on producing this simple part showed a tremendous saving of man-hours using numerical positioning control.

These figures are typical of savings being realized daily by users of NPC. This simple part was purposely chosen to remove any impression that significant savings are made only on the big complex jobs. Numerical control can produce results like this even with routine day-to-day work. Although we have used a drilling operation in our example, we could have selected examples from many other types of applications. These include welding, stamping, riveting, step-shaft turning, boring, straight-line milling, shearing, burning, bending and rolling.



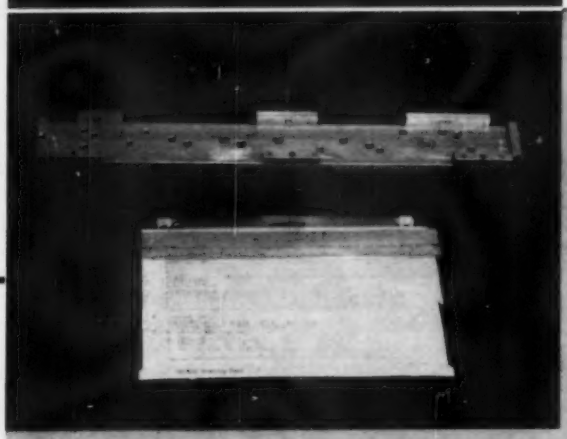


Fig. 1. Mounting foot, made of aluminum, used in comparison of numerical positioning with conventional methods.

Fig. 2. Actual jig used to produce part shown in Fig. 1 compared to program and punched tape used with NPC.

What can numerical positioning control be used for? One definition states that this system can be applied to any operation in which a part or tool is moved from one point to another, stopped, and work then performed. The example of the drill press is a good illustration. A hole is drilled, the table is then re-positioned and another hole is drilled, and so on until the job is done. What positioning path is taken by the table to get from one position to another is unimportant, as no work is done until positioning has been completed.

Numerical control can also be used in milling or in turning step-shafts on a lathe. In general, the cuts are made while the tool is in motion parallel to a machine axis. In these cases, start and end points of the cut are defined numerically. There are a great number of applications for numerical control. We will show you some of these applications ranging from the simple to the complex.

Metal cutting shears, Fig. 3, are found in every sheet metal shop. The positioning of the backstop can be directed with a simple one motion numerical control. It is practical to use inexpensive manually-set dials to introduce the numerical position information because, in most cases, we are not faced with a constantly changing position. Two important benefits are faster setup and repetitive accuracy. This latter point is important in connection with re-runs.

Another operation that can benefit in the same way is rolling, Fig. 4. A high degree of consistency with varying diameters being rolled results from accurate positioning of the upper roller. Numerical positioning control will also eliminate time consuming trial and error setups.

Applications such as rolling and shearing require constant operator attention. Frequently a quantity of parts are rolled or sheared with the same position setting. In these cases, where the position setting remains unchanged for a period of time, fully automatic operation from punched tape would add little to the efficiency of the operation. The greatest advantage in these operations are greater accuracy and faster setup.

Automatic operation with punched tape control has a number of advantages in other applications such as bolt circle drilling and tangent bending. For example, bolt circle drilling, Fig. 5, requires a number of accurate indexes of a rotary table.

This is usually time consuming and it is difficult to maintain repetitive accuracy. A one-motion control, operated from a punched tape, can index the rotary table rapidly with high accuracy and increase the efficiency of the operation up to several hundred per cent.

Obviously, punched tape input is the practical choice because of the ever changing drill location

Table shows results of a time study made on producing part shown in Fig. 1 by both conventional and NPC methods.

Operational Procedure	Time in Hours Conv.	NPC	Hours Saved
1. Making drill jig	17		
2. Making numerical program		0.33	16.67
3. Set up and production on multispindle drill press	3.77		
4. Set up and production on numerically-controlled turret drill		1.23	2.54
Totals (hours)	20.77	1.56	19.21

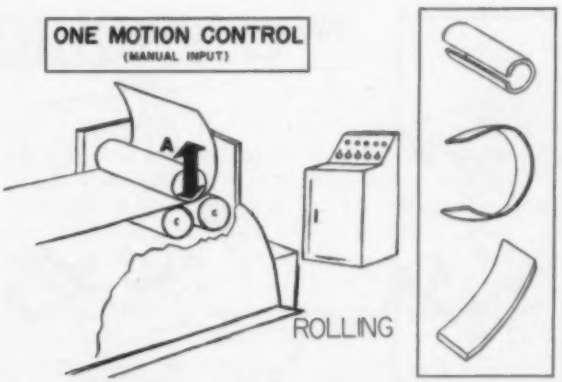


Fig. 4. NPC eliminates trial and error setups on this circle rolling operation and provides a high degree of consistency.

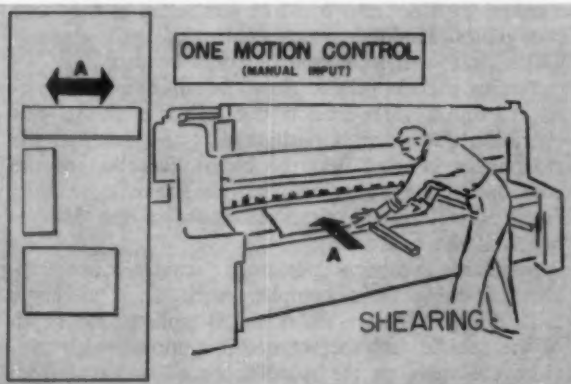


Fig. 3. Positioning backstop of this metal-cutting shear can be directed with a simple one-motion numerical control.

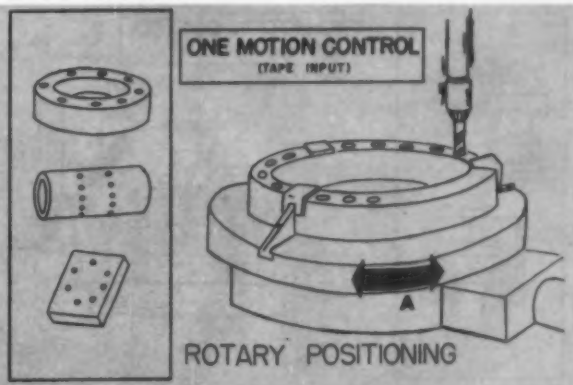


Fig. 5. Punched tape control is ideally suited to bolt circle drilling which requires accurate indexing of a rotary table.

around the bolt circle. In addition, numerical positioning control eliminates the drill jig or the expensive, time-consuming hand layouts often used in conventional practice.

Another economical use of one-motion control operated from punched tape is bending, Fig. 6. Here, the workpiece must be positioned in several places to produce the final form. Assume, for example, that you are to make 10 identical pieces with four bends

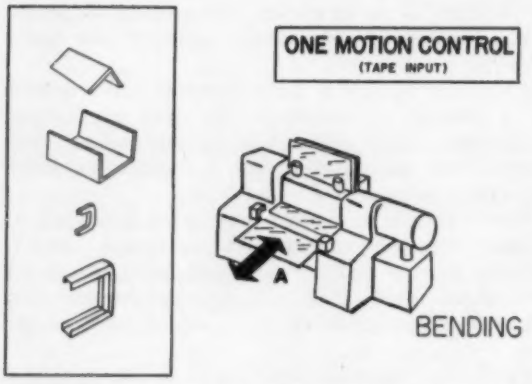


Fig. 6. Fast positioning of stops with punched tape control reduces amount of handling required to make multiple bends.

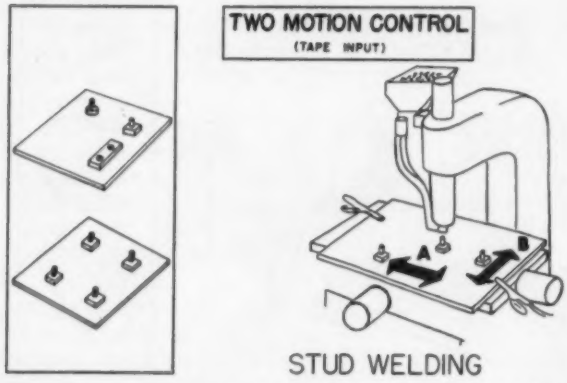


Fig. 7. Two-motion tape control on a resistance welder table increases stud-welding production and improves accuracy.

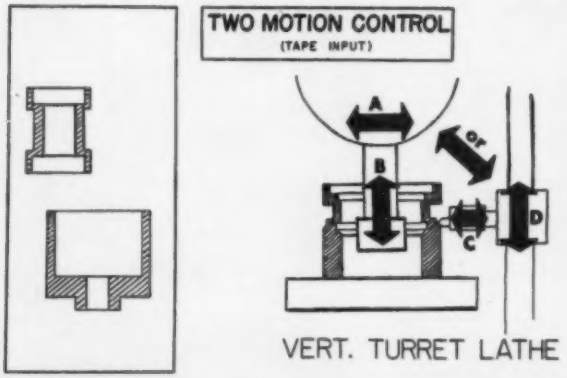


Fig. 8. Two-motion control is used in two different ways on vertical turret lathe or combined in a four-motion control.

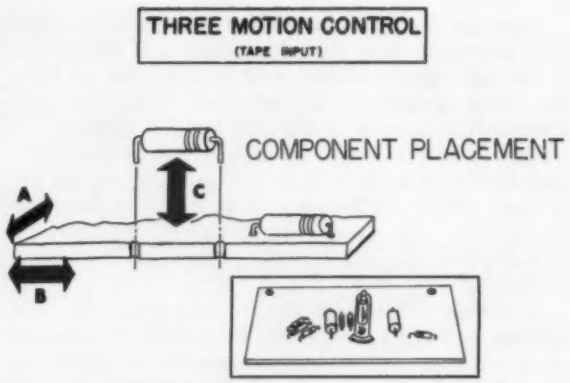


Fig. 9. Positioning of component parts on this printed circuit board is accomplished with this three-motion control.

each. The conventional method is to set up for the first bend, work all 10 parts, set up for the second bend and handle all 10 parts again. With this system, each part must be handled four times or the equivalent of handling 40 parts.

With numerical positioning control, the stops are automatically positioned through a complete cycle and each part is handled only once. There is a four-to-one decrease in handling time alone plus increased accuracy obtained by automatically positioning stop.

Two-motion tape control on a resistance welder, Fig. 7, can increase stud-welding production and improve accuracy. General-purpose clamps hold a sheet onto a positioning table controlled by a tape.

In operation, the table is positioned, a stud is fed from the hopper and welded, the table is positioned again and the next stud is welded until all studs are in place. Other welding applications, such as spot, projection and certain arc and seam welding applications can also benefit from tape control.

A very popular machine in industry is the vertical turret lathe, Fig. 8. This machine could be directed by either a two-motion or a four-motion control. With the two-motion unit, the rail-head can be controlled in both the horizontal and vertical planes. For example, in a facing operation the B motion would be positioned to determine height from the table and the A motion would be used to define the start and finish points of the machining operation. Or, in a like manner, the side head could be controlled in the same two planes. If simultaneous control of both heads is desired, a four-motion control would be used.

Placing parts in printed circuit boards can be accomplished by a three-motion control, Fig. 9. In this operation the board is positioned in-and-out, and the component inserted into the board. Selection of the components themselves will be less subject to human error as will the physical placement of the components on the board.

Standard numerical positioning controls are capable of doing more complex work, such as angle milling, Fig. 10. Here the A and B motions, the depth of the spindle and the rotary tilt motion, which provides the angle on the spindle, are all operated from a four-motion control. Varying angles and slopes can be produced.

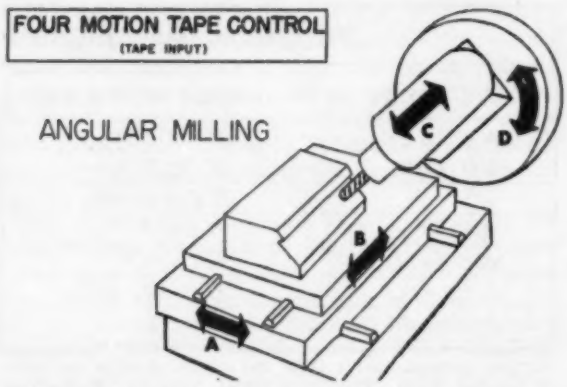


Fig. 10. Varying angles and slopes can be reproduced on this angle milling machine using a four-motion tape control.

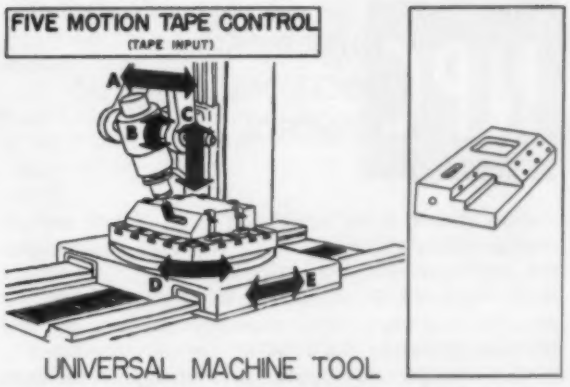


Fig. 11. Intricate shapes with pockets, angles, slots and steps can be produced automatically with a five-motion control.

With a five-motion control, Fig. 11, the universal tool becomes a reality. Again, the in-and-out and cross-slide motions, depth of drill and angle of the spindle are controlled. To this is added the rotary motion which allows us to cut circles. Intricate shapes with pockets, angles, slots and steps can be produced automatically on this machine.

These examples are just a few of the many applications possible and have been chosen to demonstrate what can be done with pre-engineered control systems. Although we are only surface scratching here, these examples should be able to stir your imagination and give you some ideas of where numerical positioning control can be used in your plant.

NPC HOW IT WORKS

Programming is probably the most mysterious single thing about numerical control and scares more people away from it than anything else. Numerical positioning control needs no computer or high-powered mathematics and is so simple that its basics can be taught in five minutes.

Certainly it is based on numbers but you already know the number system, so it presents no new learning problem. It is merely the familiar coordinate system used by every machine operator who has ever positioned a compound table. Any point on a workpiece can be reached by moving the table back and forth on its axis and the saddle motion in and out.

In like manner, any point can be located with numbers by measuring from a zero reference corner so many inches along the A coordinate and down a number of inches on the B coordinate as shown in Fig. 12. We began our explanation of numerical positioning control with an example of a simple base plate or mounting foot. Now let's go back to it and program it for the General Electric Mark II, two-motion, numerical positioning control.

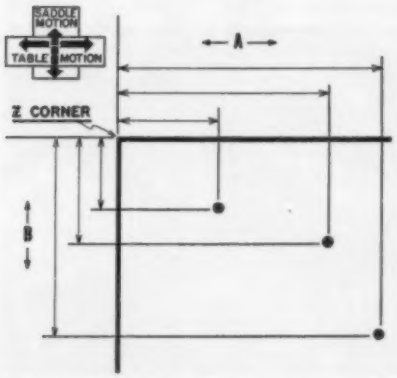


Fig. 12. Position on part can be located by coordinates measuring from corner.

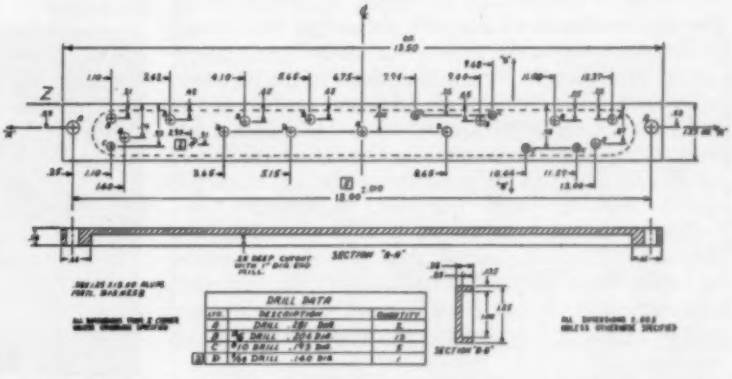


Fig. 13. Zero is in the upper left hand corner and all measurements are made on the two axes at this point. Program for each hole is written as shown.

NPC — Numerical Positioning Control

Zero corner is the upper left hand corner and all measurements are made on the two axes beginning at the zero corner, Fig. 13. Conventional practice is to make hole-to-hole measurements but it should be apparent that zero corner measurements pose no new learning difficulties and is inherently more accurate.

Our example may appear to oversimplify the zero corner matter for the part in question is squared. Obviously, the zero corner can be located off the part as well as on it to take care of round parts, irregular shaped parts or rough castings.

The program manuscript is a tabulation of the dimensions of each hole. All dimensions are made from the zero corner and are normally expressed in decimals of five digits. Where zeros occur in a dimension, they must be used, not assumed. Thus the program manuscript for our mounting foot begins with the dimensions for each hole written as shown in Fig. 14.

Capital letter A is used to tell the control that the five digits following it apply to the table motion of the machine. Either motion may be chosen to be motion A, but once this choice is made it remains fixed.

Digits represent the dimension the table is to be positioned to, as measured from the zero corner, and the workpiece is located with respect to this point. Our first hole has the table dimension of one-quarter inch from the zero corner and is written in the manuscript as A00250. It is read A00.250.

In actual programming, the decimal point can be used if desirable. If used, the control will disregard the decimal and will read right through it. In playing a program back through an automatic typewriter, the decimal point will be recognized and will print A00.250. Because the decimal point is not needed in making up our program manuscript, it was omitted.

A similar procedure is followed for the saddle. In this case the letter B is used to tell the control that the five digits following apply to the saddle motion. Again, either motion may be chosen as motion B but this must remain fixed once the choice has been made.

Everything we have said about motion A similarly applies to motion B. Our B dimension to the first hole is B00530. That is 0.530 in. from the zero corner as measured on the B coordinate. Since each motion has been identified to the control by the use of the letters A and B, they can be programmed in any sequence such as A00250, B00530 or B00530, A00250.

Since stepping switches are used to store information in the Mark II control, these serve as a memory to retain the numerical positioning information until commanded to change. Even in cases where temporary loss of power is experienced, the data is retained and not lost.

Due to this memory, it is not necessary to repeat information if we have two or more holes on the same

PROGRAM MANUSCRIPT

TABLE MOTION (A)	SADDLE MOTION (B)
A00250	B00530
A01100	B00310
	B00930
A01400	B00740
A02420	B00450
A02900	B00910
A03650	B00625

Fig. 14. Dimensions for table and saddle motions are listed in tabular form. This is machine program manuscript.

PROGRAM MANUSCRIPT

TABLE MOTION (A)	SADDLE MOTION (B)	TURRET STATION (C)	AUXILIARIES
A00250	B00530	C1	F
A01100	B00310		
	B00930		
A01400	B00740		
A02420	B00450		
A02900	B00910		
A03650	B00625		
A00250			
A04100	B00450		
A03650	B00625		
A02420	B00450		
A01400	B00740		
A01100	B00310		
	B00930	C4	
A02900	B00910	C5	
A00250	B00530	C2	
			F
			M

Fig. 15. Completed program manuscript showing table positions, drill spindle and operation of the auxiliary functions.

Fig. 16. Punched tape is prepared from program manuscript on a standard Flexowriter or IBM automatic typewriter.

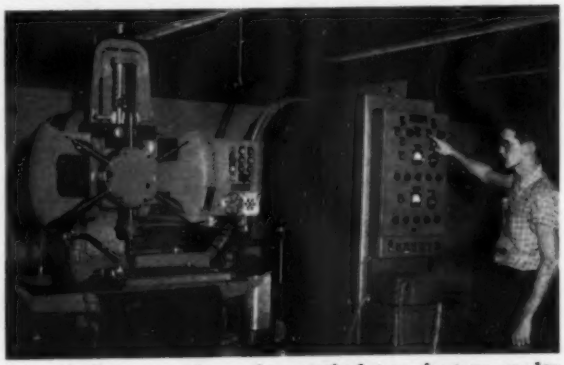


Fig. 17. Operator places the punched tape in tape reader and presses "start" button to produce part automatically.

centerline in the same plane. As an example, the four holes in the center of our part require changes only to the A or table motion. The B or saddle motion dimension is not repeated. The control remembers the B dimension and the program for the next three holes only spells out the changing A dimension. This saves programming time, length of tape and speeds up the reading operation.

Our example has proceeded to the point where we have the table of our turret drill press properly positioned under the spindle and we are now ready to drill. At this point we use the control to select the drill we wish to use. The Mark II control provides signals for the control of 10 auxiliary functions. Two of these provide for 10 choices each, while the other eight are "on" or "off" type functions.

Letters C to M have been allocated for these auxiliary functions with the exception of the letter I. It has been deleted because of possible visual confusion on the part of the operator or programmer between the letter I and the number 1. Let's see how each of these letters can be used.

One of the functions that can provide up to 10 choices is indicated by the letter C. Numbers from zero to nine follow the letter denoting which choice is to be used. In our example, we are going to drill the part on a six-spindle turret drill. The letter C indicates to the control that the number following is a turret station number.

If we place our center drill in turret station 1, then programming C1 will bring this drill into play. Similarly we can put the required 0.281 drill in turret station 2, the 0.204 drill in station 3, 0.193 drill in station 4 and the 0.140 drill in turret station number 5.

To put a 0.281 drill through our position for hole number 1, we would program A00250B00530C1. On the second line of the program we would put C2. The first line of information will move the table to the proper point and initiate the center drill. The second line of information tells the control to stay at the same spot and send the 0.281 drill through.

Letter D, like C, indicates a function which can have up to 10 choices. Both letters are programmed in the same manner. Letters E, F, G, H, J, K, L, and M ordinarily mean only one thing in a program. Each of these letters can turn something "on" or "off." For example, we can assign the letter E to turn the coolant pump "on," and F to turn it "off." The other letters can be used in like manner for any of the other auxiliary functions you may wish to control.

At this point we can show a complete program manuscript, Fig. 15. The coolant pump is turned "on" at the beginning, auxiliary E, and turned "off" at the end, auxiliary F, while letter M is used to stop the spindle.

Note that this program center-drills each hole then comes back around for the drilling operation. Time studies have proved it takes less time to move the distance between holes than to rotate the turret each time.

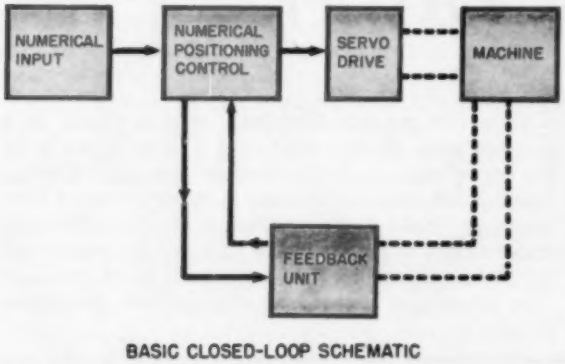
Figure 15 is a completed program manuscript ready to be given to the typist to make up a punched tape. The tape is prepared on a standard Flexowriter or IBM automatic typewriter, Fig. 16.

With programming completed and the numerical input prepared, all in 20 minutes against the 17 hours required to make the drill jig, the drilling machine is ready to run automatically under the direction of numerical positioning control. Now we have only to take the tape out to the machine, place it in the reader and press the "start" button, Fig. 17. From then on the control takes over. Now let's see how it works.

Most numerical positioning control systems operate as a closed loop system. A simple comparison is the room thermostat common to our heating systems. The thermostat is set by adjusting the temperature dial. This setting is our command to the heating system.

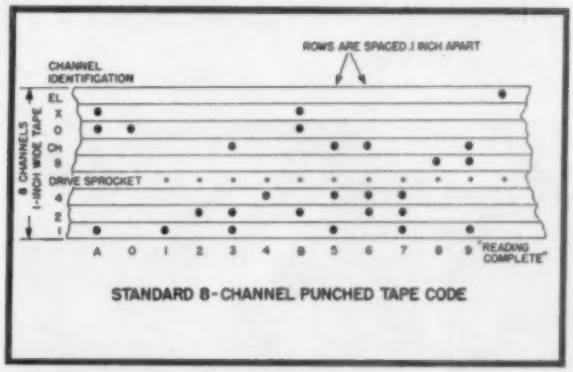
Next, the thermostat measures or senses the temperature in the room. If it is too low, the thermostat throws a switch that turns on the heating plant. When the command temperature is reached, the thermostat again senses this and turns off the furnace. This action repeats continuously to keep the room temperature at a comfortable level near our command setting.

In similar fashion, we give a command setting to our numerical positioning control by feeding it position information stored in the punched tape. Our command to the control is to move the proper machine members to a given point. Instead of turning a heating plant "on" and "off," we are now controlling motors or hydraulic pistons. We not only tell them how far to move but also in which direction. Our sensing or measuring device tells the control when we have reached the



BASIC CLOSED-LOOP SCHEMATIC

Fig. 18. Feedback unit senses position of machine members and compares this to position information on punched tape.


ROWS ARE SPACED 1 INCH APART
CHANNEL IDENTIFICATION
8 CHANNELS 1-INCH WIDE TAPE
EL
X
0
DRIVE SPROCKET
A 0 1 2 3 4 8 5 6 7 8 9 "READING COMPLETE"

STANDARD 8-CHANNEL PUNCHED TAPE CODE

Fig. 19. Punched tape provides eight channels of information. The odd-number holes check on reading accuracy.

command setting and the motion stops within a tolerance band of where we specified. A basic closed loop schematic is shown in Fig. 18.

Closed loop systems are based on what control engineers call the error signal. This is not meant to present a negative picture in your mind but is the term used to explain how these systems work. Refer back to the thermostat for a moment. The thermostat will not take positive action unless there is some difference between the command setting and the actual room temperature. This difference is the error signal and this kind of error must be present or the thermostat will not act.

Similarly, there must be a difference between the actual position of a machine member and the command position. When such difference exists, the sensing unit or feedback device sends a signal to the control and motors are actuated to move the machine until the command position is reached and the error signal falls to zero.

With this background on closed loop systems, we can begin to examine this control more closely. Let's start by taking a closer look at the punched tape, Fig. 19. Note that rows are spaced 0.1 in. apart along the tape and that there are eight channels of information down the tape. In each row there is always an odd number of holes. This provides us with a check, for if an even number of holes are ever read, a light flashes to indicate a reading error and the machine stops.

As the tape passes through the reader, contact pins reach up. Where there is a hole, the pins pass through completing a circuit to a relay which closes to send a signal into the control. This signal is directed by the master distributor switch to the proper storage bank. When all the information necessary for one operation is read and stored, a signal is sent from the reader and the control acts upon the complete block of stored information.

The storage banks are stepping switches which make contacts with taps on a transformer that correspond to the digits called for on the punched tape. Circuits are thus set up and command voltages sent on to the position measuring units.

Position measuring units are mechanically tied to the moving members of the machine and when moved, create a discrete voltage for each point along the member's axis. Thus there are two voltages to be considered, a command voltage where we want to be and a position voltage telling where we actually are. These two voltages are compared in the control and the difference is the error signal.

This error signal is the information needed to cause action, in this case to cause the motors to drive the machine members to the desired point. The error signal has both polarity and magnitude. Polarity controls the direction of the motors, rotation and the magnitude of the voltage controls the amount of motor rotation.

By controlling the drive motors, we actuate the machine members to bring the workpiece into proper position under the tool. As the members move, the feedback unit keeps sending back new voltages as the position changes. The error signal gradually falls to zero as the command voltage and the feedback voltage are brought into correspondence. When this condition is reached, the workpiece is in the desired position, within specified limits of accuracy.

Positioning actually takes place in much less time than it takes to read about it with speeds up to 900 in. per minute practical on some applications. The control reads the next block of information while the machine is acting upon the present command.

Different speeds of operation may be obtained but speed and accuracy are related in that high accuracy requires a slower speed and low accuracy allows high positioning speeds. Typical repeatable accuracies and speeds of the Mark II control system are plus or minus 0.0005 in. at 150 ipm, plus or minus 0.00032 in. at 60 ipm and plus or minus 0.00005 in. at 20 ipm. These figures, of course, assume good mechanical condition of the machine.

NPC HERE'S THE PAYOFF

Since tool position knowledge is now placed in a punched tape, we no longer need a jig to locate holes nor do we need to give the operator a detailed drawing with this information. The operators only concern is to keep part blanks in the machine as the control has the responsibility of producing the part. We can expect and get savings in tooling costs and direct labor plus lead time advantages because we can get into production faster.

Fig. 20. Jigs for this part cost $1300. When numerical positioning control is used only, a $20 holding fixture is needed.

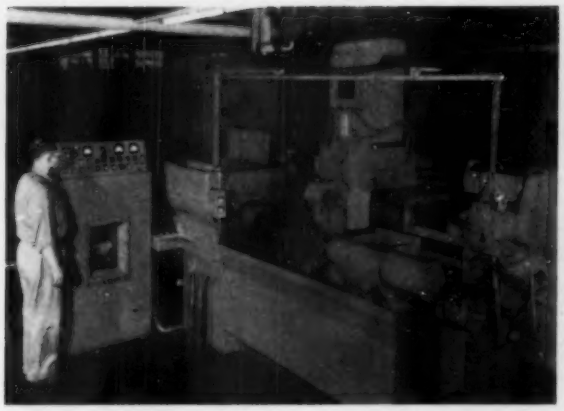


Fig. 21. Cost of preparing punched cards was one-tenth the cost of making templates for this step-shaft lathe operation.

Fig. 22. Planning and programming this part takes about four hours. Conventional tooling costs from $5000 to $7000.

We have made the claim that numerical positioning control eliminates jigs and produces savings in tooling costs. Here are six examples to support that claim. Jigs for this part, Fig. 20, cost $1300. With NPC all that was required was a simple $20 holding fixture.

On the lathe shown in Fig. 21, NPC and tracer operation were compared in making stepshafts. The cost of preparing the punched cards was one-tenth the most of making templates. Lead time, too, was cut from ten to one.

In the application shown in Fig. 22, it takes about four hours to plan and program the part shown. Compare this to conventional tooling costs of from $5000 to $7000.

Fixture costs of new parts were reduced 60 to 80 per cent on this general purpose mill, Fig. 23. On just one part, a tooling cost of $2000 was saved. About a dozen parts like this and the equipment has paid for itself.

Fig. 23. Fixture costs for new parts were reduced 60 to 80 per cent on general purpose mill. Equipment soon pays off.

No jigs are needed on this NPC layout drilling machine, Fig. 24. Tooling costs in one part were reduced from $1350 to $20. On another job $1000 worth of fixtures were eliminated.

The Mark II controlled drill press shown in Fig. 25 eliminated the need for 124 different drill jigs at an average cost of $1500 each. The cost of the jigs is not surprising when you consider that there are 2400 holes per part in three "pinhole" sizes with a required accuracy of plus or minus 0.002 in. between holes. On its first assignment, this machine eliminated the need for special tooling costing six times the investment in the machine and its control.

It is a common practice among aircraft suppliers to use general purpose machinery because of the short average run. The job shown in Fig. 26 used to be done under manual control. Two men were needed to move this barrel-shaped exhaust liner around between electrodes to weld on tabs. It took 16 man-hours to make the 1600 welds required to complete one part.

Now it takes one man less than five minutes to load the part and push the "start" button. One hour and 20 minutes later he takes it off. In the meantime he is productively engaged on another machine. NPC not only provides the flexibility needed for the many different designs run on this machine, it increases output

Fig. 24. No jigs are needed on this NPC layout drilling machine. The tooling costs were reduced from $1350 to $20.

and reduces scrap. With a savings of $26,000 a year, this investment paid off in two years.

A common job in almost every shop is prototype work. This is the strictly one-of-a-kind job that is usually scribed, center-punched and finally drilled. Here is a sample, Fig. 27, from our own shop. There are 100 evenly spaced holes with a prescribed accuracy

NPC THE PAYOFF

of plus or minus 0.005 in. Hand layout and drilling on a standard radial drill press took eight hours.

With NPC we eliminated hand layout and did these things. We programmed the part, typed out the program sheet, made a punched tape, made a duplicate tape for the dispatch office, set up the machine and drilled the part. All this was accomplished in 56 minutes. The actual time on the machine was 11 minutes.

A tracer control and NPC are teamed up on the same machine, Fig. 28, to make possible full contouring plus drilling and boring with one setup. Many parts can be completely machined with only one or two setups and eliminates numerous transfers from one machine to another.

New machine tools reflect the growing interest in NPC as a positive method of increasing productivity. This machine, Fig. 29, was designed for NPC. The combination of machine and control design advances have produced a tool of maximum flexibility.

Thirty tools are placed, at random, in the tool magazine and are selected and changed automatically as needed by punched tape command. The part is indexed, drilled, bored, tapped, and milled all by punched tape control.

Savings in tooling costs and direct labor alone have been accomplished at the rate of $102,000 a year. In other instances, it has been found that payback in one year could be realized on in-process inventory savings alone. **End**

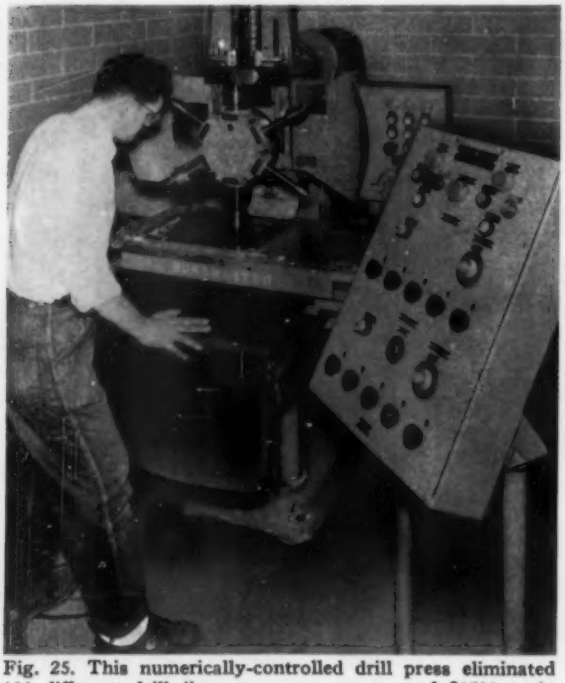


Fig. 25. This numerically-controlled drill press eliminated 124 different drill jigs at an average cost of $1500 each.

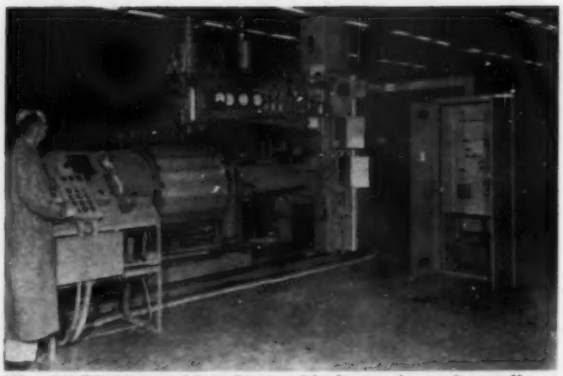


Fig. 26. Welder welds tabs on this jet engine exhaust liner. Saving $26,000 a year, investment paid off in two years.

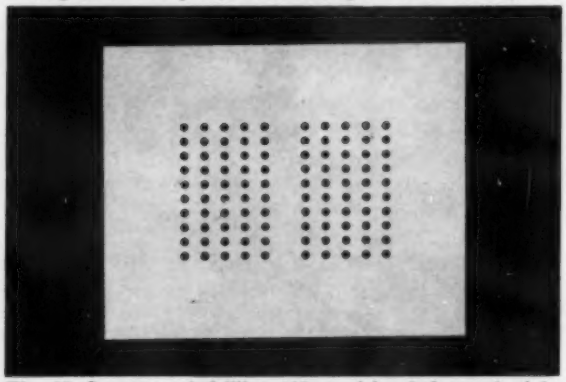


Fig. 27. Layout and drilling 100 precision holes took eight hours. All steps required for NPC took just 56 minutes.

Fig. 28. Tracer control and NPC team up to make possible full contouring plus drilling and boring with one setup.

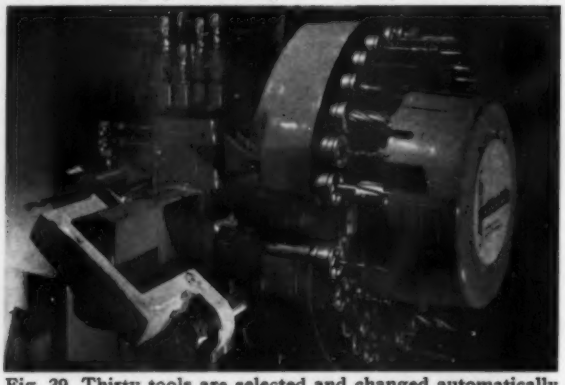


Fig. 29. Thirty tools are selected and changed automatically from this tool magazine under command of a punched tape.

RED TAG SAFETY AT FIRESTONE

AN EFFECTIVE industrial safety program will include either the "lock-out" or the "tag-out" methods of protecting maintenance men while they are repairing machinery and equipment in the plant.

The "tag-out" method, which is the one used at plants of The Firestone Tire & Rubber Company, requires maintenance men to attach red-colored, 3½-in. by 5½-in. tags bearing their names on the main switch or valve of the machines on which they are working.

In this manner the red tag serves as the maintenance man's temporary deed to the machine while it is "tagged-out." Production departments have relinquished their rights to the machinery until the tag is removed.

By having each maintenance man use his own red tag and permitting no one other than himself to remove the tag and start the machine will prevent serious accidents, Firestone safety engineers say.

Another important phase of the program is encouraging personnel other than maintenance men to use red tags when they are inspecting machinery and equipment. These include production supervisors, plant engineers, and plant cleaning personnel, who may approach the machinery without realizing the hazards involved when they fail to use the tag-out system. In such cases, all that is needed to create an accident is for the production employee to return to his job and start the machine which has not been tagged-out.

Reminding employees of the importance of plant safety is a constant program at Firestone. Monthly safety meetings, for example, are conducted and the programs presented are usually those set forth by the Industrial Commission of Ohio.

Red tags spell only one thing—**DANGER.**

The following explanation of DANGER and red tags is given by Robert Harvey of the Plant Engineering department.

Damage to equipment. Injuries to personnel, loss of wages, and loss of company earnings will occur when machinery is started by mistake during repair.

Accidents will happen if red tags are not used. Resulting injuries will be serious.

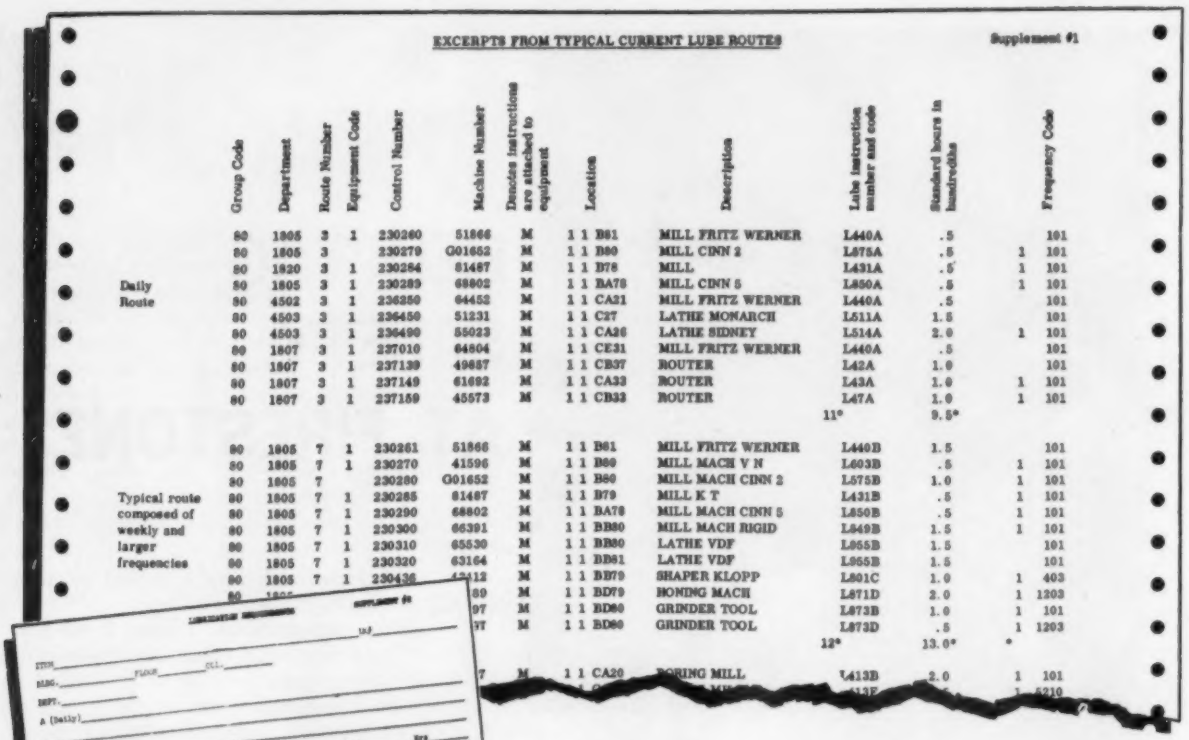
Nuisance, yes, red tags are a nuisance. Sometimes the main power switch or valve is inaccessible or you just simply forgot to bring a tag, or the job requires so little time that it does not seem necessary to tag-out the machine. But living without an arm or hand is an even bigger nuisance.

Gamble is a habit. We all take chances now and then, but usually the chances are not too important. But taking a chance with a hand or an arm is important. Working on machines without red tags means the law of gambling averages will sooner or later catch up with you.

Effectiveness of red tags has been proven by a record of accident prevention. Red tags mean the machine is not to be put into operation. They mean it will not be started until the tag is removed. No accidents can occur, therefore, until the machine is again a moving unit.

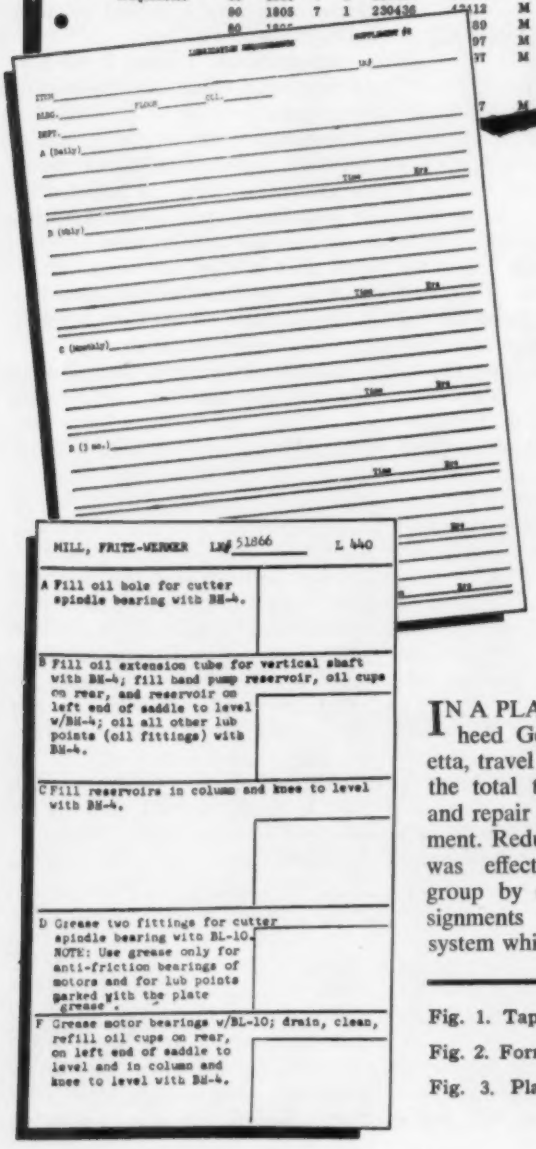
Reprimands are in order if a man is gambling with his life or the lives of others. The procedure is simple, inexpensive, and requires little time and effort. A violation of the red tag method is sheer recklessness.

In conclusion: If proper use is made of Reprimands to obtain the Effectiveness of red tags to eliminate the Gamble, we will accept the Nuisance in order to prevent the Accidents and Damage in our plants. **End**



EXCERPTS FROM TYPICAL CURRENT LUBE ROUTES — Supplement #1

	Group Code	Department	Route Number	Equipment Code	Control Number	Machine Number	Denotes instructions are attached to equipment	Location	Description	Lube instruction number and code	Standard hours in hundredths		Frequency Code
	80	1805	3	1	230260	51866	M	1 1 B61	MILL FRITZ WERNER	L440A	.5		101
	80	1805	3		230279	G01652	M	1 1 B60	MILL CINN 2	L575A	.5	1	101
	80	1820	3	1	230284	61487	M	1 1 B78	MILL	L431A	.5	1	101
Daily Route	80	1805	3	1	230289	68802	M	1 1 BA78	MILL CINN 5	L850A	.5	1	101
	80	4502	3	1	236350	64452	M	1 1 CA21	MILL FRITZ WERNER	L440A	.5		101
	80	4503	3	1	236450	51231	M	1 1 C27	LATHE MONARCH	L511A	1.5		101
	80	4503	3	1	236490	55023	M	1 1 CA26	LATHE SIDNEY	L514A	2.0	1	101
	80	1807	3	1	237010	64804	M	1 1 CE31	MILL FRITZ WERNER	L440A	.5		101
	80	1807	3	1	237139	49857	M	1 1 CB37	ROUTER	L42A	1.0		101
	80	1807	3	1	237149	61692	M	1 1 CA33	ROUTER	L43A	1.0	1	101
	80	1807	3	1	237159	45573	M	1 1 CB32	ROUTER	L47A	1.0	1	101
										11°	9.5°		
	80	1805	7	1	230261	51866	M	1 1 B61	MILL FRITZ WERNER	L440B	1.5		101
	80	1805	7	1	230270	41596	M	1 1 B60	MILL MACH V N	L603B	.5	1	101
	80	1805	7		230280	G01652	M	1 1 B60	MILL MACH CINN 2	L575B	1.0	1	101
Typical route composed of weekly and larger frequencies	80	1805	7	1	230285	61487	M	1 1 B79	MILL K T	L431B	.5	1	101
	80	1805	7	1	230290	68802	M	1 1 BA78	MILL MACH CINN 5	L850B	.5	1	101
	80	1805	7	1	230300	66391	M	1 1 BB80	MILL MACH RIGID	L849B	1.5	1	101
	80	1805	7	1	230310	65530	M	1 1 BB80	LATHE VDF	L955B	1.5		101
	80	1805	7	1	230320	63164	M	1 1 BB81	LATHE VDF	L955B	1.5		101
	80	1805	7	1	230430	42412	M	1 1 BB79	SHAPER KLOPP	L801C	1.0	1	403
	80	1805				69	M	1 1 BD79	HONING MACH	L871D	2.0	1	1203
						97	M	1 1 BD80	GRINDER TOOL	L873B	1.0	1	101
						97	M	1 1 BD80	GRINDER TOOL	L873D	.5	1	1203
										12°	13.0°		
						7	M	1 1 CA20	BORING MILL	L413B	2.0	1	101
												1	6210



MILL, FRITZ-WERNER Lse 51866 L 440

A Fill oil hole for cutter spindle bearing with BH-4.

B Fill oil extension tube for vertical shaft with BH-4; fill hand pump reservoir, oil cups on rear, and reservoir on left end of saddle to level w/BH-4; oil all other lub points (oil fittings) with BH-4.

C Fill reservoirs in column and knee to level with BH-4.

D Grease two fittings for cutter spindle bearing with BL-10. NOTE: Use grease only for anti-friction bearings of motors and for lub points marked with the plate grease.

F Grease motor bearings w/BL-10; drain, clean, refill oil cups on rear, on left end of saddle to level and in column and knee to level with BH-4.

TAPE DATA CUTS LUBRICATION TRAVEL TIME

By D. M. HANDROP, Maintenance Service Planner, Lockheed Aircraft Corp., Georgia Div., Marietta, Ga.

IN A PLANT the size of the Lockheed Georgia Division at Marietta, travel time is a large portion of the total time required to service and repair all machinery and equipment. Reduction of this travel time was effected for the lubrication group by changing lubrication assignments to an organized route system which is issued on tapes.

Fig. 1. Taped data is used by oilers.

Fig. 2. Form for setting up the needs.

Fig. 3. Plastic envelope information.

Previously, lubrication was performed by an oiler assigned to a specific area. This method largely depended on an individual's memory as to the frequency and lubrication requirements of all the equipment within his assigned area. The disadvantages of such a system are apparent.

This is how our program was set up: Lubrication requirements were determined from a plant-wide survey. This survey included the types of lubricants to be used on a machine as well as the allowed time and specific lubrication instructions. Once these requirements were de-

veloped, they were analyzed and a decision was made as to what would be a master route or normal pattern of travel for the oilers throughout the plant.

Individual lubrication requirements were then set up and serially numbered so that the end result could be compared to a postal route. Routes were prepared by accumulating the time required by each item and progressing along the master route until a weekly load was obtained for the individual routes. Transmittals which included the lube requirements and other data, were prepared and submitted to the data processing department.

Flexibility was built into these routes by assigning control numbers—differing approximately by increments of ten digits. This numbering flexibility accommodates most normal moves of machinery and equipment so that it has been necessary to renumber only a portion of the routes in one or two instances where major moves have occurred. It is necessary to change only the control number and location when equipment is moved from one place to another. The frequencies, allowed time, and other data as contained in the card may be kept intact.

Present instructions are classified as either A, B, C, D, E, or F which correspond to a daily, weekly, monthly, quarterly, semi-annual, or annual frequency. Instructions are typed on standard forms and encased in plastic. When equipment is initially scheduled for lubrication, these instructions are issued and attached to equipment. See Fig. 3.

The master deck of IBM cards, as originally prepared, is kept intact except for changes in location, instructions, or frequency as deemed necessary by current operating practice. The data processing department makes a weekly run of items to be lubricated by selecting only the frequencies which are applicable for the next work week.

Cards are kept in the proper sequence during this operation so that the end result is the individual lube routes on paper tape. See Fig. 1. Since this run is already in individual route sequence, further processing is not necessary and it may be released for work to the lubrication group at least one or two days before the next work week.

Each oiler works from these tapes and performs the lubrication work as specified thereon. When the machine has been serviced, the oiler posts the date serviced to a gummed label attached to the corresponding instruction encased in plastic. The posting of the date serviced permits the observation of machines on the floor to ascertain if the instructions and frequencies are compatible with current lubrication requirements, as well as a comparison of the last date serviced.

Return trips to the lubrication crib are kept at a minimum by the use of lubrication carts which were designed and built for this specific application. See Fig. 5. These carts are filled with the various types of lubricants as required for each of the routes at the beginning of each shift. In effect, the oiler is practically self-sufficient and requires only infrequent trips to the lube crib and then usually for large quantities of a specific lubricant for oil changes, etc.

At the end of the work week, tapes are returned to the control group and checked for completeness and filed by the work week and route number. A cross reference file is maintained by machine number from which the appropriate filing week may be easily ascertained. Tapes are kept in this file for a period of one year and then destroyed.

The lube route system has proved invaluable to us since it practically eliminates the necessity for remembering when equipment should be lubricated. Once the instruction is prepared, it is permanently recorded and issued in route sequence. This route sequence eliminates the need for further assigning of work.

Necessary reassigning of personnel either for vacations, sickness, etc., creates only minor problems in training or tie-in. **End**

Fig. 4. In the plastic envelope which D. M. Handrop holds in his right hand are specific instructions for oiler.

Fig. 5. Carts are used in the routes to carry supplies for the oilers and save steps to and from storage crib.

Left: View of AiResearch Service Corporation's coin-cafeteria shows self-service condiment-creamer bar. Below: Mattel, Inc's. new 476 capacity coin cafeteria diner.

MACHINES THAT FEED MEN

The What, Where and How of Vending Machine Restaurants

SAYS A PLANT engineer in Tulsa, "Used to be we only had to worry about men and the machines they fed. Nowadays, we've got a new problem: machines that feed men."

So saying, he recognizes an in-plant phenomenon: the industrial "automat"—automatic coin-operated restaurants.

Since 1954 (when the usual plant vending machine dispensed little more than cold drinks, peanuts and candy), industrial vending has leaped twenty-fold. Currently, some 4,000,000 coin-actuated robots—many of them in-plant—cater to appetites large and small.

But whether your plant has installed only a handful of "supplemental feeding" venders (the traditional vending machine) or, as some, replaced the cafeteria with "automatic feeding" robots, plant men find themselves with new logistical problems.

Foremost among them: where—and how—best to install vending machines?

Concedes a plant man in Chicago, "It'd be easy if you could stick a vending machine—or a whole battery of them—in any convenient, out-of-the-way place. But the easy way isn't usually the best."

Ideally, vending machines should stand at the hub of a plant "intersection"—the vortex of heaviest traffic. Yet, they mustn't clobber a well-plotted traffic pattern, clog aisles or add to the housekeeping chore. Neither must they be too far from essential utilities: electricity and domestic water.

"Where and how the coin-robots

are installed . . . depends on what kind of 'automats' you're talking about," vouches another plant man.

Rightly, he diagnoses the increasing complexity of robots . . . and their growing role in-plant.

Roughly, there are two types:

1. Supplemental Feeders—the plant-common vending machine that dispenses cigarettes, candy, cookies . . . and perhaps hot coffee, hot chocolate and cold drinks. Essentially, supplemental machines back up existing in-plant feeding, serve up between-shift, work-break edibles . . . a snack but not a supper.

Their likeliest residing place: a plant's production area, and especially at the hub of in-plant traffic.

2. Automatic Food Venders—a new, sleek, highly efficient breed of vending machine which menus a wide variety of hot and cold items, is actually a replacement for the usual plant cafeteria (or, at least, replaces its kitchen and hot line).

Their likeliest residing places: your present cafeteria or specially laid-out "automatic restaurants", whose only food sources are the robots.

Although outside vendors—who own and generally maintain the machines—may "revittle" them, it's the plant engineering department that pipes them with water and electricity (110 volts is usually enough), and more often than not picks the spots . . . that, and plot-plans traffic to and from the robots.

For its efforts, plant engineering reaps a kind of spatial bargain—as at one eastern plant where automats, replacing the cafeteria, have literally handed plant men a bonus 1000 sq ft (an area once devoted to kitchens and serving lines).

When Mattel, Inc., one of the nation's big-time toy makers, moved its operations into its new 353,000 sq ft plant in Hawthorne, Calif., it designed (with the vendor's help) an elaborate "robot restaurant". Substituting for a plant cafeteria-kitchen, the automats are currently serving 1650 employees (as many as 476 in one sitting).

"And," says Mattel's Robert Mitchell, vice president in charge of Industrial Relations, "the automat setup saved us fully 1500 sq ft . . . space more profitably put to production."

More "Sit-Down" Area

Mattel's facilities engineer, John Heller, equates the space bonus in terms of a 50 per cent boost in sit-down area—at no space-cost to the plant itself.

"If we'd put in a complete kitchen, it would have taken at least 1500 sq ft—half the cafeteria's seating area."

Significantly, thirteen robots at Los Angeles' AiResearch Service Corp. are squeezed into but 162 sq ft (at least 800 sq ft less than for a conventional kitchen and service line). Moreover, they're feeding 750 employees on two shifts, as many as 100 every seven minutes.

Joining the automat parade is Chicago's Skil Corp. (which has installed a 200-seat robot restaurant). And so is General Electric at its big River Works in Lynn, Mass. Robots now serve their 12,000 employees and replace a former cafeteria.

Facing up to an invasion by automats, many a plant engineer asks himself: where best to put them?

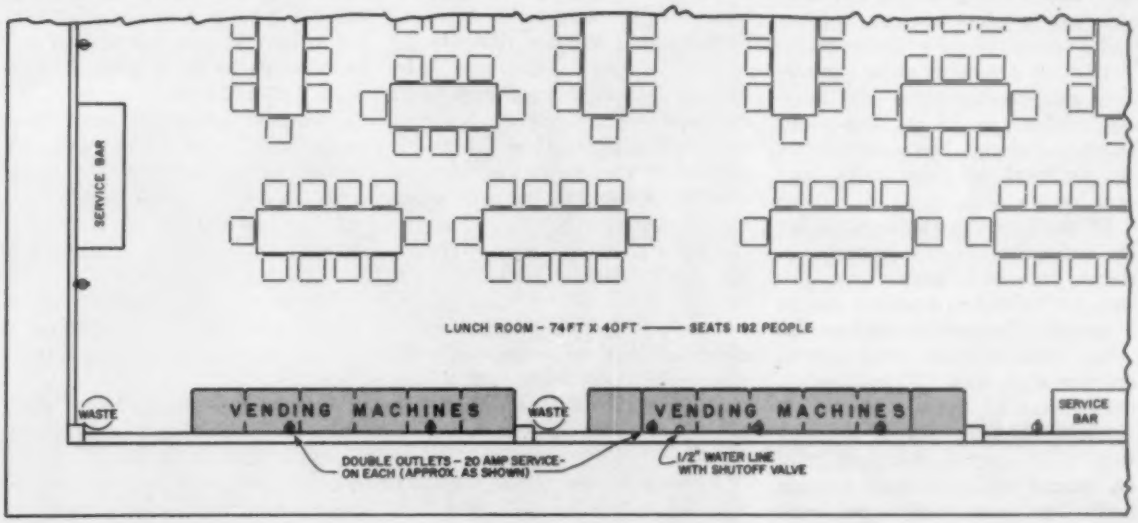
Some kindred questions: 1. What, if any, special sanitary and health rules apply to robot food machines? 2. What constitutes a "robot restaurant"—a plant cafeteria served solely by food machines?

To get the answers, PLANT ENGINEERING called on Douglas Moore, vice president of Davidson Brothers, big west coast industrial vendor and, through its recently formed Automatic Retailers of America, Inc., the nation's third-ranking caterer to plants—via robots (ARA operates in 13 states, serves more than 1000 industrial accounts).

"Although plant and engineering area vending machines," says Mr. Moore, "may dispense the same items, their location—and decor—are different."

As a plant engineer, you may install a battery of 5 "basic" vending machines (cigarette, candy, bever-

This is a plan view of one portion of Mattel's cafeteria. Thirteen vending machines and two service bars are sufficient to service 1650 employees with a top capacity of 476 people in one sitting. Machines saved 50 per cent of seating capacity.


SERVICE BAR
LUNCH ROOM - 74FT X 40FT —— SEATS 192 PEOPLE
WASTE
VENDING MACHINES
WASTE
VENDING MACHINES
SERVICE BAR
DOUBLE OUTLETS - 20 AMP SERVICE - ON EACH (APPROX. AS SHOWN)
1/2" WATER LINE WITH SHUTOFF VALVE

Left, above: the "before" view of AiResearch Service Corporation's bank of machines in company's new robot restaurant. Below: This photo shows same machines, slightly rearranged, but Formica-faced to match coin cafeteria's decor. This setup serves 100 employees in 7 minutes. On-duty attendant fills the units, makes change.

FEEDING MEN

age (carbonated), coffee, and milk and juice venders near an in-plant traffic center. Usually machines are installed in a vending niche (an off-aisle area machine-deep—the average machine is 33 in. deep—and about 16 ft long). Most aisle niches are enclosed on three sides, and open on the aisle.

Of the five basic machines, all but the coffee brewer (fresh brew variety) draw 4-6 amps, take 110 volts a.c., with two machines run on a circuit. The coffee machine, as other more complex food robots, requires a separate 110-volt circuit, draws about 12 amps.

Since vending's aim is to carry food to customers, machines must be placed where there's greatest traffic. In production areas most vending locales are near 1. rest rooms (anywhere from 20 to 30 feet from them); 2. major aisle intersections; 3. tool cribs; 4. occasionally, near in-plant time clocks.

"No vendor," continues Mr. Moore, "expects management or its engineers to reorganize a plant around vending machines. Still, it's important to locate machines as close as possible to domestic water lines and electricity."

Such an "ideal" locale—combining traffic and utilities—is often close by rest rooms.

Involved for plant engineers is construction of a vending niche, the running of ⅜-in. water lines to machines and hookup of electricity. Some city codes demand more—as we'll see.

Regardless, the "plant" robot is a plain jane (new though it may be) compared to what Moore terms "an engineering department robot."

It's the same-type machine—but often dolled up in a Formica front, the Formica matching the engineering office's decor. Moreover, most engineering robots are relegated to convenient "coffee break rooms" off the main engineering area.

"It's a matter of decor," explains vendor vp Moore, "that—and management's aim to make its executive and engineering offices places of individuality."

Just as few managements encourage a "sea of drawing boards" layout for their engineering departments, neither do they want to duplicate, in engineering, the vending machine line-up of the plant area.

Automated Restaurants

Since both hot-service and kitchen facilities are, in effect, built right into the robots, plant engineering need run no steam lines, install no jacketed kettles, worry not a whit about gas lines or big power panels. They simply don't exist in a coin cafeteria. Often, in fact, these utilities can be diverted to production.

The usual 12 to 14 robot coin-cafeteria squeezes as many as 2000 meals into an area 3-4 ft deep and perhaps 40 to 60 ft long; at most some 180-240 sq ft.

Swing-lid containers stow used paper cups, cans (hot meals are usually served in 8 to 8½-ounce cans) and other refuse. The swing-lid units do the job of costly and complex - to - maintain dishwashers and garbage disposers.

Moreover, as vendor Moore points out, "the robot cafeteria is already developing a personality all its own."

Typical is Mattel, Inc.'s robot cafeteria—which aims simultaneously to serve both office and production employees so that, at least over lunch, they come to know one

another ("and," says Mattel's industrial relations chief, Mr. Mitchell, "learn to communicate").

Thirteen robots are niched into one wall along Mattel's 3000 sq ft, ultra-modern cafeteria, which seats 196. An adjoining patio—with barbecue-type redwood benches—seats another 280.

The robots' Formica fronts blend with the room's decor. Off to one side are tables for condiments and water dispensers.

Automats like these can be squeezed into area too small for a cafeteria kitchen, serving line, seating area. Thus many a small room can be used for food service.

Sanitary Codes

Though sanitary codes governing installation of food venders vary city-to-city and state-to-state, a typical and pioneering code—Rules and Regulations Relative to Food and Drink Vending Machines and Machine Locations—was set up in Los Angeles last year.

Among its provisions:

1. Water Supply: "Where the water supply is directly connected to the carbonation system (of a vending machine) two approved-type check valves, or their equivalent, must be installed.

"Where the check valves are not of the self-cleaning type and do not pass the "sand" test, a screen of not less than 60 mesh to the inch and of such area as to provide free flow between maintenance periods, shall be installed in the water supply line immediately ahead of the check valves. Such screens and check valves shall be installed in an accessible location with couplings or union fittings, and shall be removed and inspected once a year or more often, if required."

2. Under-Machine Access for Cleaning: "The bottom of the machines shall be supported on sanitary legs or supports providing a free and unobstructed space at least 6-in. high, or the machine shall be mounted on casters or rollers which permit it to be easily moved . . ."

Other codes generally prohibit the installation of food machines (especially "wet food" types) out-of-doors, in some types of chemical process areas or, for example, in laundries. Usually required: a city installation permit. Special specifications for valving guard against a carbonated drink machine's CO_2 backing up in a plant's water supply.

An operational-maintenance code for vending machines has been laid down by the U.S. Public Health Service in its Publication No. 546.

"Robot placement isn't really complicated," concedes a plant engineer. "Still, in a facility as large as mine—with more than 85 vending machines—you've got to hold the City Code in one hand, a plant utility schematic in the other and keep your eyes on the production traffic-flow . . . before deciding where to place a robot."

No matter why or where you decide, it's a safe bet that you—and plant engineers nationwide—will increasingly work a kind of logical sleight of hand—as you deploy plantdom's growing army of . . . machines that feed men. **End**

At Douglas' Santa Monica aircraft plant this typical array of "Basic 5" machines serve the production line. Ideal locations: near tool cribs, at traffic intersections near restrooms.

Building and Equipment Design Offers:

FLEXIBILITY PORTABILITY SAFETY

Fig. 1. Portable rotary vacuum filter system is rolled onto freight elevator.

By C. A. HARMAN, Research Engineer, Monsanto Chemical Co., Nitro, W. Va.

LABORATORY BENCH—Giant Size is an apt description of the Engineering Research Laboratory of Monsanto Chemical Company's Organic Division Research Department at Nitro. Here, in plant-type equipment, including reactors up to 100 gallon capacity, nearly any laboratory experimental setup can be duplicated. Conversely, full plant scale equipment and processes can be "scaled-down" to a convenient experimental size for more economical experimentation.

The engineering laboratory is basically a pilot plant and its normal uses cover four basic purposes:

To prove-out the production feasibility of new chemical processes developed in the research laboratories.

To determine, and define, process variables important in "scaling-up" a process to full plant size.

To demonstrate proposed improvements for present plant operations, both process- and equipment-wise.

To prepare modest sample quantities of new materials for sales development.

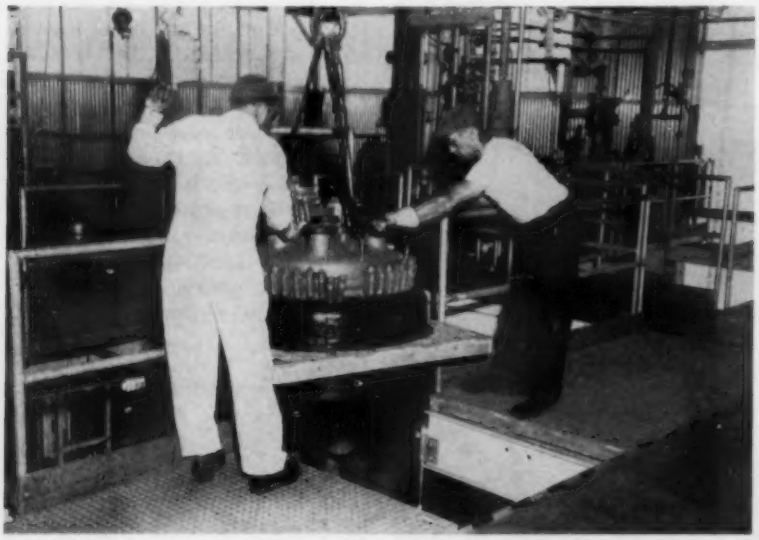


Fig. 2. Reactor vessel, mounted in base plate, is dropped into place in floor recess.

In designing the building for maximum utility in carrying out these functions, three important goals were given top consideration:

1. Provide facilities with the necessarily high degree of safety, so important in experimental chemical engineering.

2. Provide the highest practical degree of portability and flexibility to all types of equipment in order to reduce the over-all cost of expensive specialized equipment, and to make the available equipment useful for many uses at a low level of "change-over" expense.

3. Provide a building with minimum maintenance expense through the use of low cost, corrosion-resistant materials of construction wherever possible.

The building is a 60 ft by 60 ft structure, providing four floors with 12 ft head-room. A one-story office and laboratory (bench-scale) area is attached for use by the engineering group, clerical, and technical assistants. Ample room for future expansion of the building's functions is also provided.

Outer walls of the building are unpainted aluminum corrugated siding with a generous number of glass-fiber reinforced polyester plastic panels to provide natural lighting. The building is well ventilated by two intake fans located on the fourth floor which distribute filtered, heated air to all floor levels through a duct system. The concrete floor areas

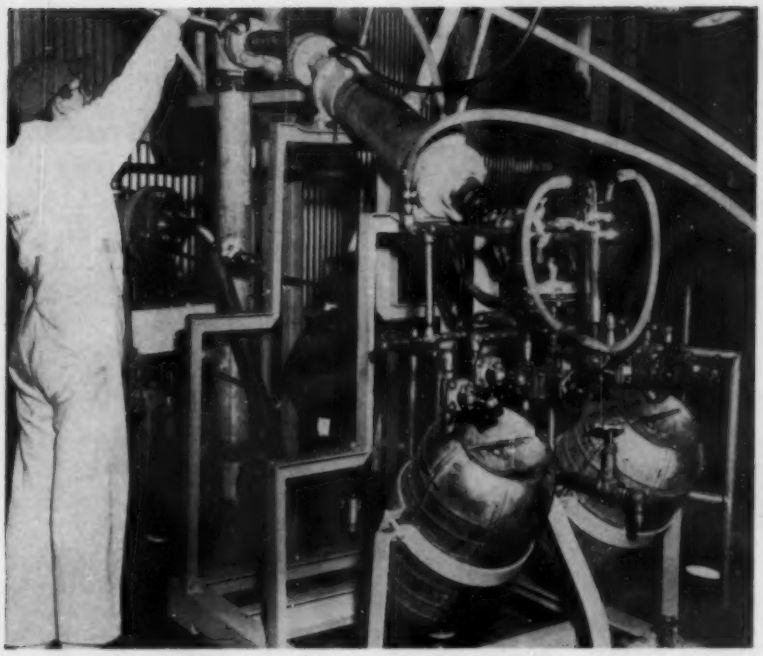


Fig. 3. Self-contained stainless steel condenser-receiver unit rolls into position.

were finished with a topping containing iron filings, which provides resistance to corrosives, and an extremely hard, non-sparking surface. The structural steel throughout the building is heavily galvanized and protected with vinyl type coverings.

In two corners of the building an open area (20 ft by 6½ ft) has been provided to allow construction of tower type equipment up to 50 ft in height. The second and third floors are also served with an open center bay, which provides ready access to reactor stations.

Reaction vessels, up to 100 gallon capacity, are mounted in 4-ft by 4-ft aluminum frames, constructed of 1¾-in. by 3-in. box channels, and provided with aluminum tread plate, and individual toe, knee and hand level plates, or railings. These standardized frames will fit into any of 36 reactor stations facing the open center bay. See Fig. 2.

A traveling electrical hoist is mounted under the fourth floor and is used to move the reactors to any desired station on the second or third floors. Other equipment such as condensers, receivers, short columns, filters, etc., can be similarly mounted for ease in moving to the desired location.

The operating areas are served by 16 separate piping manifolds from which city water, warmed water, steam, brine, compressed air and sewer facilities can be directed to reactor jackets, condensers, etc. Temperature and flow rate indicators are provided for these services. Electrical service (440v and 110v) outlets are conveniently located in all sections of the building. Two corrosion-proof vacuum jet systems serve each side of the building through shielded glass piping and provide high (2 and 3 mm Hg) and low (60 mm Hg) vacuum levels. A cantilever type electrical freight elevator services all floors.

Maximum portability and utility of auxiliary equipment has been achieved. Nearly every piece of equipment in the building has been mounted on wheels, or pallets which can be conveniently moved with a small fork lift unit. Some of the outstanding examples of the portability achieved are as follows:

Electrical starters and circuit breaker boxes (explosion-proof) are mounted on portable aluminum frames. One of these units is shown in Fig. 4.

Electronic and pneumatic type indicating, recording, and controlling instruments are mounted on dollies and carry their own power and air purge lines.

Filters of many types, including a rotary vacuum unit, Fig. 1, are completely portable.

Complete condenser-receiver assemblies for atmospheric or vacuum distillations, constructed of glass and graphite (or stainless steel where suitable) may be moved conveniently close to a reactor station for use with a minimum of connecting piping. See Fig. 3.

Other portable equipment includes pumps, mixers, mills, scales, flakers, dryers and drum and carboy handling equipment. Much of the portable equipment offers further benefits by being readily available for interim type production facilities in another plant building.

Outstanding safety features include three eyebaths, three safety showers and two small (CO_2 type) and one large (dry powder type) fire extinguishers on each floor. A fireproof stairway provides safe emergency exit and access to fire blankets, stretchers, gas masks and other emergency equipment.

While this building has been expressly designed for the highly specialized field of chemical engineering research, its features of portability of equipment, maximum safety factors design, and the low cost corrosion-resistant construction can be utilized advantageously in experimental facilities for nearly any type of industrial activity. **End**

Fig. 4. Portable centrifugal pump with attached starter. Portable circuit breaker assembly plugs into power receptacle.

PACIFIC LIFT TRUCK CO.
YALE
PDO
YALE

Just what do you get from Yale PDQ* Service?

Yale PDQ Service is a concept that starts with equipment designed to require the minimum of service. At the same time it recognizes, realistically, that prolonged useage of any equipment inevitably will call for service. When such service is required the Yale program provides PDQ service with factory approved facilities, teams of mechanics, comprehensive manuals and a system of dispatching spare parts quickly to any corner of the country.

Q. How does the Yale PDQ Service operate?

A. Through "teams" of technicians, assigned to various functions. Some "teams" operate at the Yale factories, handling manufacturing and engineering assignments. Others are the task forces that operate in the field and come in direct contact with you.

Q. How well are the field teams technically qualified to service my equipment?

A. The teams consist of carefully picked men—factory trained. They operate in the field under the careful surveillance of experienced regional and district supervisors operating out of modern, fully equipped facilities.

Q. Are Yale PDQ Service teams in reality nothing more than rescue squads to meet emergencies?

A. Far from it. One of their important functions is "operational maintenance" which means preventing costly downtime of equipment before it occurs. Also, the field service teams are the ears and eyes for Yale engineering and production. They report on the performance of Yale equipment in customers' plants.

Q. How do I get replacement parts quickly for Yale equipment under PDQ service?

A. Replacement parts are maintained at depots in the East, Midwest, and Far West. From these depots, replacement parts are distributed to the network of Yale branches and dealers who carry stocks for immediate delivery.

Q. Do Yale Branches and Franchised Dealers carry every possible replacement part a customer might need?

A. No. But they do carry stocks of parts based on the frequency of demand by customers in the area. Furthermore, they anticipate these demands and stock accordingly. Under a system of centralized electronic data processing the inventories of all replacement parts are kept under instantaneous control. The memory of the electronic computer indicates where parts are shipped, availability by location, rate of depletions from stock, etc.

Q. So what?

A. So, when you request a replacement part which is not in stock in your immediate area, it takes only a few minutes to locate its whereabouts throughout the country and arrange for quick shipment to you.

Q. Are replacement parts obtainable for all Yale equipment regardless of age?

A. Yes. This is a particular feature of the Yale PDQ Service. Replacements are obtainable for *all* equipment—new or old. Replacement parts for equipment designed for specific applications for which parts are not standard and for very old equipment naturally must be produced on special order.

Q. Where do I get Yale PDQ Service teams when I need them?

A. The Yale PDQ Service is available in all important industrial areas throughout the United States and Canada (see your Yellow Pages). In addition, all PDQ service centers maintain service shops on wheels manned by factory trained mechanics.

Q. Where can I get further information about Yale PDQ Service?

A. Write to your Yale representative or to the Yale & Towne Manufacturing Company, Materials Handling Division, Philadelphia 15, Pa., Dept. X-006.

***Performance — Dependability — Quality**

Yale Materials Handling Division, a division of the Yale & Towne Manufacturing Company. Manufacturing Plants: Philadelphia, Pa., Forrest City, Ark.

YALE®

INDUSTRIAL LIFT TRUCKS
TRACTOR SHOVELS · HOISTS

YALE & TOWNE

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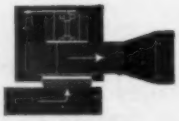
J-80707

NEW DEVELOPMENT IN AIR DYNAMICS...

airfoil centrifugal fan performance

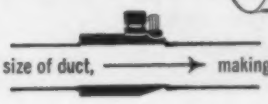
compactness To do a job that would take a conventional fan this big you need a CENTRILINE fan this small

in-line air flow means additional space saving. It allows you to do this instead of this 

fan-mounted motor Makes it possible to hang CENTRILINE fans from the ceiling

or stack them or mount them on the wall as well as mount them on floor or platform.

quiet The CENTRILINE fan performs with the same relative quietness as conventional airfoil centrifugal fans. The secret is a Westinghouse exclusive: airfoil bladed wheels and newly developed conversion vanes

inlet equals outlet Inlet and outlet are the same size. You can use one size of duct,  making installation simpler.

NOW you can have today's airfoil centrifugal fan performance without sacrificing space.

Here are the facts in a nutshell.
We have developed a fan with **in-line** air flow, **and** the performance characteristics of the airfoil centrifugal fan.
But it is smaller by as much as 50 per cent.

And think of the added space you can save with in-line ductwork . . . saves **more** than ½ the installed space over conventional centrifugal fans.

We call our new straight-flow centrifugal fan the **CENTRILINE** ® fan.

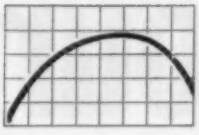
Now, from Westinghouse, you have a choice of centrifugal fan configurations—
the conventional scroll shape, or
the new **CENTRILINE** fan shape for in-line air flow.

We're ready to take your order on six sizes of **CENTRILINE** fans.
Write for the catalog.

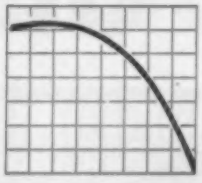
You can be sure . . . if it's Westinghouse

in half the space

® Westinghouse Trade Mark



high, broad efficiency curve **Translated into money, this means lower horsepower requirements and lower operating costs over a broad selection range.**



stable pressure-volume performance **Means the kind of precise control necessary for conventional air conditioning systems as well as the high-pressure, high-velocity systems of the future . . . plus a myriad of industrial applications.**

standard specifying tables **Since the inlet and outlet dimensions of the CENTRILINE fan are closely comparable to those of a conventional centrifugal fan of the same wheel diameter, specifying the right size CENTRILINE fan and motor requires no new set of standards or computations.** Sturtevant Division, Boston 36, Mass. **Westinghouse**

For more facts circle 575 on Reply Card

BEFORE "Operation UPlight" Assembly Products, Inc., of Chesterland, Ohio, had to supplement their general lighting system with additional fixtures to provide sufficient illumination at work levels for their precision manufacturing operations. This combination resulted in extreme brightness variations.

Only 7/10¢ per hour*...

"The combination of at least 300 footcandles along with the determination of the most practical mounting height (7′ 6″) made the selection of the lighting fixture at Assembly Products, Inc. an extremely critical consideration,"

says Consulting Engineer
Anton J. Eichmuller
Cleveland, Ohio

"However, after seeing the results of the installation, we were firmly convinced that our choice of Day-Brite CFI-30 Power-Groove Industrials was right. The resulting low-brightness and high efficiency are evident to all; most importantly to the people working in the area because it eliminates eye fatigue.

"Of almost equal importance are the excellent design and construction features of CFI-30, which were attested to by the electrical contractor (Herbst Electric Co.) who installed the Day-Brite units. These features too will pay big dividends to the owner for years to come.

"The excellence of the results, plus the fine handling of the order by Day-Brite factory and local representatives, have given us another outstanding job, fully appreciated by Mr. Saint Amour (President, Assembly Products) and myself. This is an example of another Day-Brite installation well received and appreciated."

A. J. Eichmuller (right) and Day-Brite representative Tony Dunn examine the Day-Brite CFI-30.

AFTER "Operation UPlight" Day-Brite CFI-30 fixtures, equipped with Power-Groove lamps, boosted illumination to 300 footcandles and balanced brightness with 22½% uplighting. Fixtures were mounted in continuous rows on 7-foot centers, 7½ feet above the floor. The ACTUAL difference is even greater than these photographs show.

for 300 footcandles

More light for less money with Day-Brite CFI® fixtures!

That's "Operation UPlight". The new Day-Brite CFI (Comfort For Industry) fixtures are designed to deliver the higher lighting intensities currently recommended . . . yet substantially reduce installed, operating and total owning costs. And *now*, with prices reduced as much as 17.7%, Day-Brite CFI fixtures are within the range of *every* industrial lighting application.

For actual cost figures comparing Day-Brite CFI fixtures with other lighting systems, call your Day-Brite representative listed in the Yellow Pages. See for yourself why hundreds of companies across the country have put "Operation UPlight" into action, making it the most successful program in Day-Brite history. PHONE TODAY!

**per footcandle for each 10,000 square feet. Based on 4,000-hour operation, 1¢ per KWH rate, 35% lamp discount, typical maintenance cost, and amortizing the cost of buying and installing the lighting units over a ten year period.*

DAY-BRITE

DAY-BRITE OPERATION UPLIGHT

Day-Brite Lighting, Inc.
St. Louis, Mo. • Santa Clara, Calif.

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

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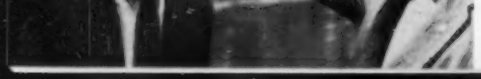
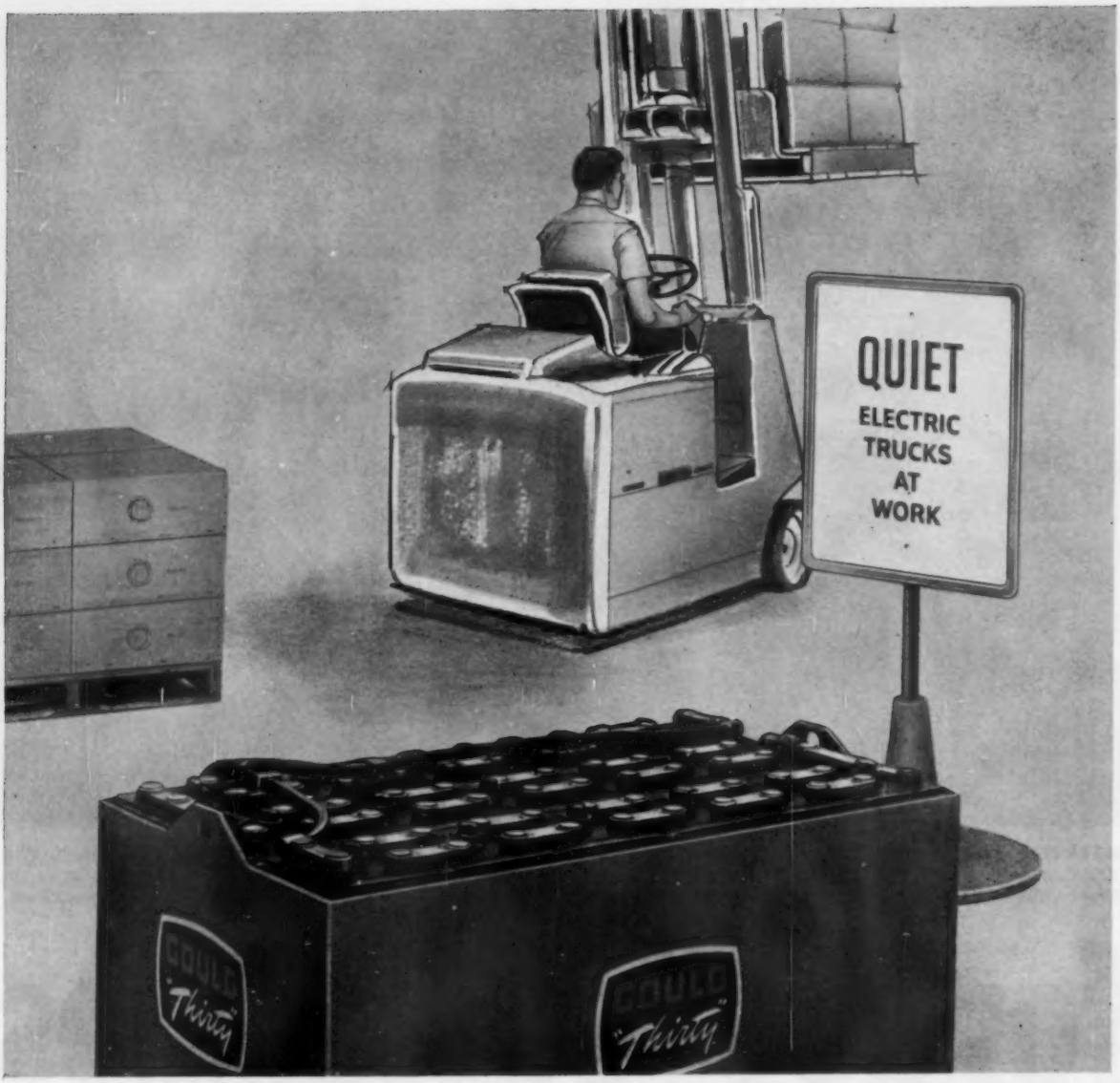


A. J. Eichmuller (right) and Day-Brite representative Tony Dunn examine the Day-Brite CFI-30.



Electric Trucks REDUCE NOISE LEVELS

Quiet operation of battery-powered electric trucks eliminates distraction and annoyance to workers performing other production work. Quiet operation is an outstanding advantage when it is necessary to give verbal instructions to truck operators or to signal them by a dispatch system. Finally, quiet battery-powered electric truck operation is a valuable safety factor—the operator can concentrate better on activity around him.

Add quietness to a convincing list of other benefits—lower operating cost, less maintenance, clean and safe operation—and you can see why users prefer electric trucks for modern, efficient materials handling.

Electric truck users generally agree on one other point, too—Gould Batteries for longer life. With the vital new Silconic Plate, Gould Batteries offer up to 25% longer life through prevention of grid corrosion.

Join the list of satisfied users who prefer this ideal combination of battery-powered electric trucks and Gould Batteries. For more complete information, write or call the local Gould representative nearest you. Ask for booklet "Why We Use Battery-Electric Industrial Trucks." Gould-National Batteries, Inc., Trenton 7, N. J. In Canada, write to Gould-National Batteries of Canada, Ltd., 1819 Yonge Street, Toronto, Ontario.

More Power to you from **GOULD**

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Day-Brite history. PHONE TODAY!

AND INDUSTRIAL LIGHTING EQUIPMENT

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Chicago Gear Mfg. Company tames tough steels, cuts costs with STANICUT Oil 208 BCS

Tames tough steels. Gears from one to 300 inches in diameter are machined by Chicago Gear. Steels up to 375 Brinell hardness are worked. STANICUT Oil 208 BCS helps them do it. STANICUT 208 contains maximum amounts of sulfur, chlorine and compounding for handling tough alloy steels. It is viscous enough to stay on tools and work, yet fluid enough for good cooling.

Cuts costs. STANICUT Oil 208 BCS is used at Chicago Gear for all gear hobbing operations and applications requiring a straight cutting fluid. There's no chance of the wrong fluid being used, thus no costly losses. One fluid cuts down inventory, saves time in keeping track of stocks, cuts paper work and ordering.

Gets service. Standard Oil's Dick Erickson is assigned to the Chicago Gear account. With a mechanical engineering degree from Purdue, plus several years' lubrication experience, Dick knows how to help a customer, knows how to supply technical help where it counts. Could STANICUT Oil 208 BCS and Standard Oil technical service help you? Ask about them at the Standard Oil office near you anywhere in the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

STANDARD

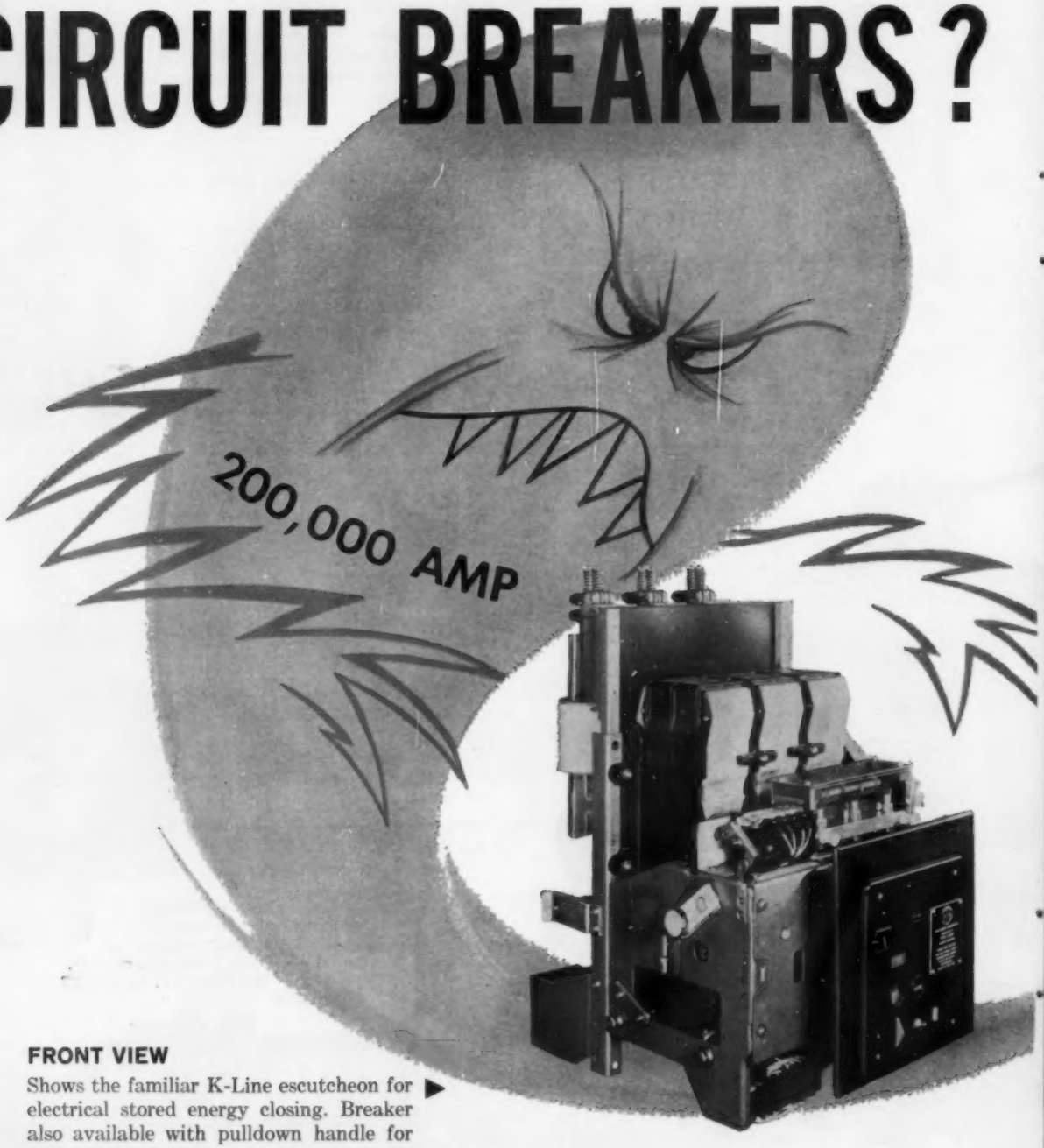
You expect more from Standard and you get it!

Quick facts about
STANICUT Oil 208 BCS

- Contains maximum amounts of sulfur, chlorine and compounding.
- Viscous enough to stay on large tools; fluid enough to flow easily, give good cooling.
- Can be used straight or diluted.
- Will not separate, become rancid or develop deposits.
- Non-irritating, non-corrosive, non-toxic.

Chicago Gear president Bob Weber (right) and Standard's Dick Erickson talk over cutting oils in front of company's new Pfauter P-2500 gear machine. Machine uses only STANICUT Oil 208 BCS cutting fluid.

HOW MANY AMPERES LURK BEHIND YOUR LOW VOLTAGE CIRCUIT BREAKERS?



FRONT VIEW

Shows the familiar K-Line escutcheon for ▶ electrical stored energy closing. Breaker also available with pulldown handle for manual stored energy operation.

I-T-E's new K-Don® protects against fault currents up to 200,000 amp—plus giving you the complete range of K-Line circuit breaker operation

Suppose you have a low current fault. The K-Don circuit breaker element gives you time delay tripping. Or a medium current fault. You get instantaneous tripping. And for really high-capacity faults, you have the current-limiting action of Amp-trap® fuses in series with the breaker.

MAXIMUM FUSE ECONOMY

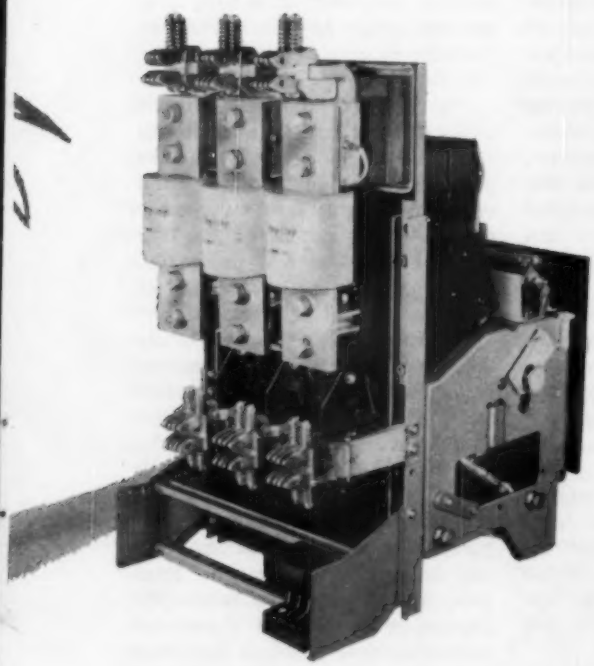
Only the I-T-E K-Don gives such complete protection—circuit breaker protection over the standard circuit breaker range and economical fuse protection from there on up to 200,000 amp. The only time fuses blow is when fault current is too high for the circuit breaker to handle. The K-Don is not a fuse hog.

NO SINGLE PHASING

The K-Don gives you this double protection all in a single compartment—saving you cost and bulk. And regardless of the type of fault, all three phases open every time. No single phasing to cause costly equipment damage.

COMPLETE RANGE OF RATINGS

Basically, the K-Don is a standard 600 volt K-Line circuit breaker with current-limiting fuses in series. Besides high current protection, you also get the advantages of expanded range trip and closed door drawout. Breaker ratings range from 30 to 1600 amp continuous, up to 75,000 amp interrupting. Versatility of protection is assured by a range of fuse ratings from 400 to 3000 amp. Drawout mountings are available in either Urelite® enclosures or switchgear assemblies. Write for detailed bulletin 4300-1A. I-T-E Circuit Breaker Company, 1900 Hamilton St., Philadelphia 30, Pa.



BACK VIEW

◀ Shows Amp-trap current-limiting fuses in series with circuit breaker. Fuses are on line side so they protect the breaker as well as connected equipment.

I-T-E CIRCUIT BREAKER COMPANY

For more facts circle 579 on Reply Card

SELECTING A MAINTENANCE SUPERVISOR?

This 11 Point Checklist Will Help

By **BURKE W. WOMBACHER,**
Plant Engineering Consultant

Place a number from 1 to 11 to the right of the factors listed to indicate the order of importance in which you would select a maintenance supervisor. Let's see how close you come to author's rating.

Appearance	_____
Seniority	_____
Age	_____
Leadership	_____
Home life	_____
Potential	_____
Gets along with people	_____
Outside activities	_____
Manual skills	_____
Background	_____
Education	_____

Fig. 1.

A RECURRENT problem that I have faced many times during my many years of experience as plant engineer is that of selecting a man for the job of maintenance supervisor.

My repeated errors in past selections caused me to realize that I could not rely on my judgement of people by taking them at face value and based on impressions. I determined that what I needed was a Planned Selection Program.

The first step in developing any such program is an analysis and evaluation to determine what is required and why. I started by setting down some facts, impressions and truisms, such as:

1. Good supervision starts with good selection.

2. Supervision in maintenance is tough as the men work in scattered locations.

3. Good supervision will boost maintenance efficiency.

4. Workmen will reflect the attitude of the supervisor.

5. The maintenance supervisor is in contact with people at all levels of the organization.

6. The maintenance supervisor is the front line representative and salesman for plant engineer.

7. The plant engineer's performance is most readily and usually judged by his maintenance efficiency.

8. The plant engineer can be condemned by a poor maintenance organization.

Deliberation over these and other facets of maintenance coupled with unpleasant memories led me to a serious conclusion;—the *success* or *failure* of the best of plant engineers is dependent upon the impressions made by his maintenance supervision. Impressions made by the efficiency of his maintenance organization, in general, and, specifically, by his front line representative—the maintenance supervisor—are factors that can critically determine the future of the plant engineer.

Finally, I hit upon the idea of making up a rating chart and have used it for many years to measure men against the job, and to select the best man from a number of candidates for the job of maintenance supervisor and for other supervisory jobs you may have in the plant as well.

This immediately improved my average of good selections so that my score is only one man lost through error on my part during the past 10 years or more.

At this point, I suggest that you refer to the factor list in Fig. 1 and number them per instructions, then in the text following we can discuss these and see if we agree.

The factors are listed in what I consider to be their order of importance:

1. Gets along with people—The ability to get along with people is what I consider to be the prime requisite for the job of a maintenance supervisor. If a man does not rate highly here, he should be immediately removed from further consideration.

The job of maintenance supervisor is about as tough a one as you can get. His work brings him and his men into contact with every conceivable level of personnel, as well as people on the outside. The attitude and personality of his men will be a reflection of his own attitude and personality.

2. Leadership—Consider here the job complexity of a maintenance supervisor. He is required to be both a servant and a master at the same time.

He maintains a service organization which is at the beck and call of others, and usually has the problem of two few men to serve too many people. Yet, he must give all the people he serves the impression that he has a personal interest in their problem, and often substitute personality for prompt service.

As a master, he must direct and train his men in such a manner as to insure that they will perform efficiently with the proper attitude,

working in scattered locations and with a minimum of supervision.

The potential maintenance supervisor should be measured primarily on the main element of leadership which is the art of handling people. This goes hand-in-hand with the factor of getting along with people.

Secondary consideration is given to the other elements of leadership such as teaching, planning, scheduling, managing, giving orders, etc., as training by the plant engineer can correct any weaknesses in these respects.

3. Potential—Determine that the man you select is not lacking in ambition.

The best selection will be the man who wants your job as plant engineer. He can become a valuable assistant and later even replace you. Remember that you probably will not be allowed to move up in rank unless you can leave someone behind to replace you.

4. Background—Past experience and background should be evaluated in general as to the type of work done, and specific attention given to lengths of service in each past performance.

It is common to find the extremes—men with a long record and others who worked most of their life in a single place.

Personally I take a dim view of either extreme and look for a record that shows a sensible number of jobs with a medium of two to five years duration. What is wanted is a man with diversified experience but who shows he is not a "boomer."

5. Outside activities—Check on the outside interests of your candidate. Look for a man with a healthy hobby such as golf, baseball, competitive sports, or who has an interest in community, church, or club activities. You want a man who is a mixer for a challenging job in a competitive field.

Use caution in selecting a man who has another job or business on the side. This indicates energy and initiative but remember that you will probably want him available for call-in all days, all hours.

6. Home life—Look for a settled married man, preferably a home owner with a family.

Consider that a single man is unsettled and easily gone with the wind. One who has been divorced or had other family trouble obviously has not demonstrated the ability to get along with people—one at least.

7. Education—Education is becoming of constantly increasing importance in every field, so it must be of importance to maintenance also. However, as maintenance is such a broad field the factor of formal education appears lower on my list when concerning maintenance than it would in rating other areas.

8. Appearance—Do not concern yourself with a detailed comparison of physiognomies; evaluate this factor on the basis of general impression.

You will not want a sloppy looking person, or a sour-faced grouch. You will want a clean-cut, pleasant person as your salesman and front line representative.

9. Seniority—Seniority must be considered as a factor mainly because to ignore it can result in serious problems.

When you have passed over men with more seniority in making your selection, be sure you have sound reasons. And do not neglect making your reasons clear to those men and to their union steward.

This is often a difficult duty, but do not shirk it or you will pay the price later as the general morale of the group will suffer.

10. Age—Any discussion on age is so controversial that I almost hesitate to mention the subject, and in general I rate it as a factor of small importance.

In general it can probably be fairly stated that a man well along in years has less drive and vitality than a young man, and also fewer years of useful service left to give to the company.

On the other hand, a young man cannot be expected to have the knowledge, experience, patience and tolerance so necessary to maintenance work.

Assuming that these are substantial facts, then it is apparent that the best choice is along the middle path, or say an age in the range of 30 to 50.

11. Manual Skills—In days past, craft skill was a primary factor but now I rate it last.

It is desirable to select a man with such skills, and chances are he has it if he is in the position of being a supervisory candidate. However, taken by itself, I cannot place much importance on it here.

A maintenance supervisor these days is expected to concentrate on his duties as a leader, planner, and manager, and not on physical efforts.

Figure 2 shows a typical rating chart. Study this carefully and see if you can determine my reason for having selected Jones, although his point score was slightly lower than Smith or Brown. **End**

SUPERVISORY RATING CHART

Rating points: Poor-1, Fair-2, Good-3

	Smith	Brown	Jones
Gets along with people	2	2	3
Leadership	2	2	2
Potential	3	2	3
Background	3	2	2
Outside activites	2	3	2
Home life	3	3	3
Education	3	3	2
Appearance	2	2	2
Seniority	3	2	1
Age	3	3	3
Manual skills	2	3	3
Totals	28	27	26

Fig. 2. Although Jones has the lowest score of the three men, he was selected for the job of maintenance supervisor. Why did the author select Jones?

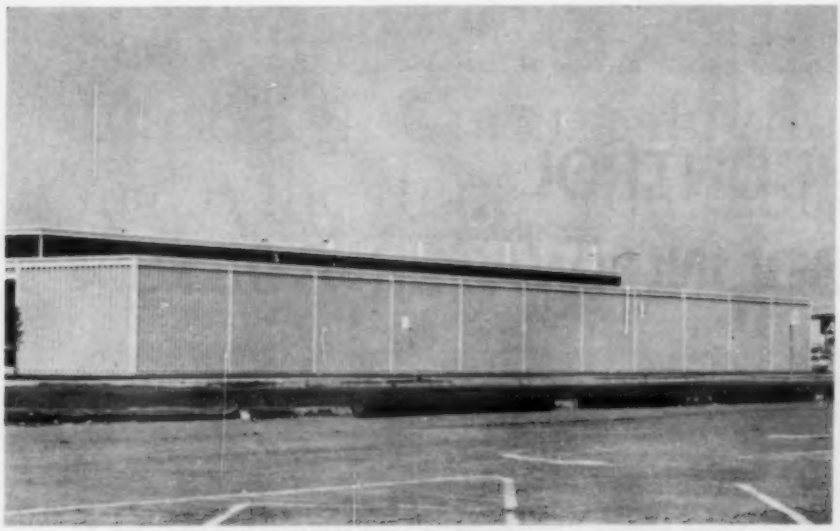
Answer: Jones rated the highest in the most critical factors necessary for success: his ability to get along with other people, leadership and potential.

TV SERVES CHEFS

Production chef writes instructions on horizontal pane of glass above TV camera. Messages are reversed, and seen on monitors throughout kitchen.

Provisions in store room are palletized for handling by push-type fork lift.

Cooking ranges in the kitchen are equipped with hoods that employ induced draft rotating elements to trap grease.



New United Airlines flight kitchen occupies 25,000 sq ft. It is equipped with newest equipment, newest ideas, to make meal preparation fast and efficient.

Executive chef demonstrates how their mobile tray racks are used with roll-in type refrigerators in flight kitchen.

IN THE FLIGHT KITCHEN

CLOSED CIRCUIT television and other advanced equipment is being used to achieve maximum speed and efficiency in food preparation in the flight kitchen opened recently by United Airlines at San Francisco International Airport.

The one-level structure occupies about 25,000 sq ft. Features include a ceramic tile floor laid with an acid-resistant plastic compound mortar; sinks, storage bins, dish cabinets and similar items mounted on wheels for convenience and mobility; closed circuit television to provide rapid communications between food preparation areas; walk-in refrigerators with glass doors; and humidity-controlling fog jets of water in refrigerators used for storing cakes and pastries.

Garbage, compressed and dried in a disposer, is placed in 50-gal drums. Liquid extracted from it is returned by closed circuit feed to the cleaning tables to be reused for conveying scraps.

The kitchen is designed for a peak output of 6000 meals daily. **End**

Compressors for refrigeration rooms are located in attic space above ceiling. Glass doors are personnel safety factor.

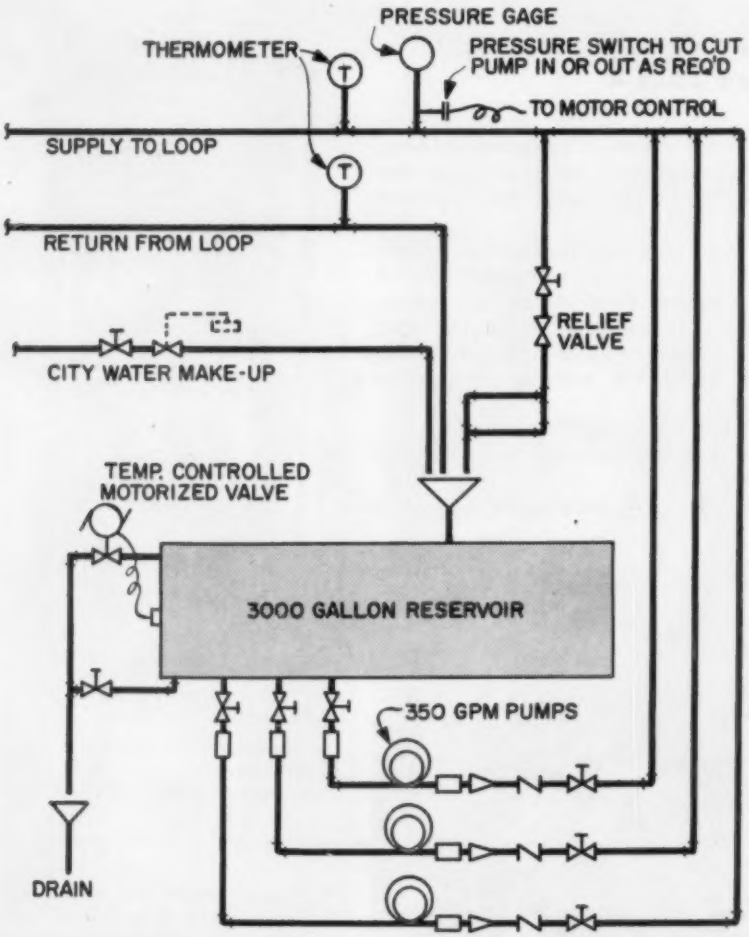
Dishwasher, with 44-ft conveyor, is one of many pieces of equipment on wheels for mobility and convenience in kitchen.

KENNETH BIDDLE, Plant Engineer, Sundstrand Aviation, Rockford, Ill., tells how

AUTOMATIC CONTROL REDUCES COOLING WATER COSTS

HERE AT SUNDSTRAND Aviation we have a fairly large number of water-cooled heat exchangers. Since cooling water ran through these exchangers continuously, and because the load on the exchangers is intermittent and not very demanding, a considerable amount of water was wasted.

Attempts to control this waste failed due to lack of cooperation based on the excuse that the exchangers did not cool properly without full flow. Finally, we decided to correct the fault by installing an automatic flow control system. The installation resulted in a circulating loop as shown in the sketch. It was a loop of approximately 600 ft of 3-in. pipe with taps made to the load as required. The loop is sectionalized by valves so certain sections can be shut down without disturbing others.



Schematic diagram of circulating loop for cooling water. Note that the loop is sectionalized so that portions of loop can be isolated without disturbing others.

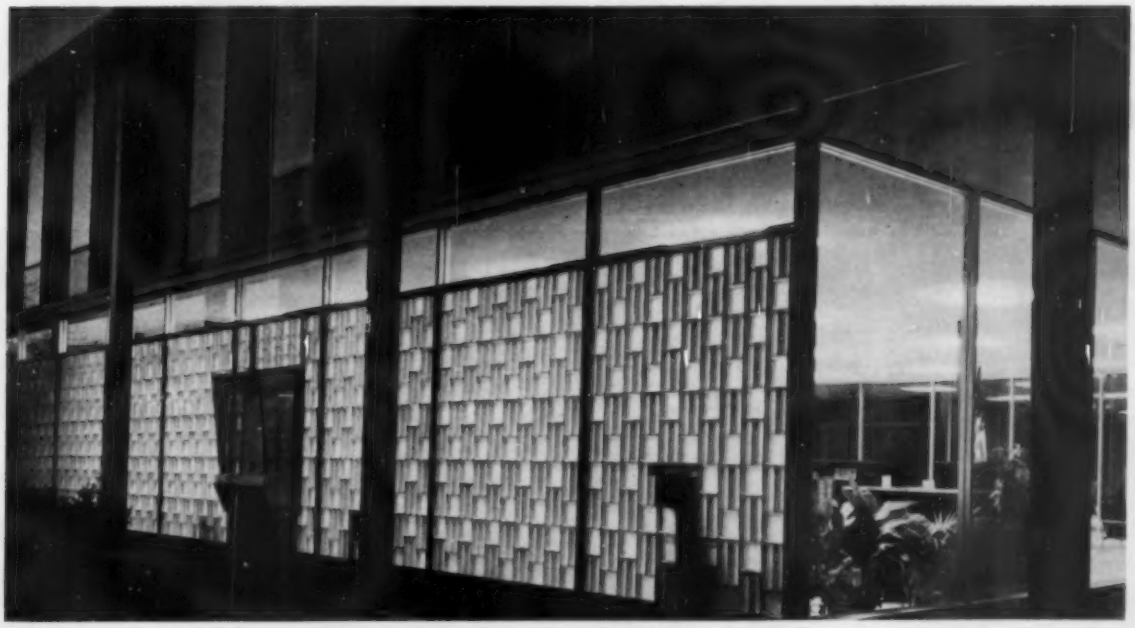
Water from a 3000-gal reservoir is circulated through the loop and the connected loads until the water in the tank is 100 F. This temperature limit is adjustable and can be raised or lowered if conditions so demand. When this temperature limit has been reached a temperature-sensitive element opens a motorized valve and drains water from the tank. City water at 55 F is then added by a float-operated valve until the lower limit of the motor-operated thermostat is reached (approximately a 10 deg differential).

Three pumps, one of them a standby unit, circulate water through the loop. The two pumps that are in operation are automatically controlled by a pressure switch in the discharge. The pumps are periodically rotated to standby for 1. servicing; 2. to equalize wear; and 3. to make sure that all three are in operating condition. In selecting the pumps we chose a type that was being used in another operation in the plant; thus, if necessity demanded, the standby pump could be transferred to that duty. One added safety feature: we can, if necessary, tie the city water directly to the loop in the event of pump trouble.

When the temperature of the water in the reservoir gets too high it is reduced by dumping water and replacing it with fresh, cool water from the city mains. Because the water temperature does not get too high we have experienced little difficulty with scaling. However, the loop does have provisions for circulating de-scaling compounds should the need arise. Some of the rejected water is used, during the summer months, for our roof sprinkler.

Thus far, the loop system has reduced our water costs to about 30 per cent of the previous billing. **End**

See why Pittsburgh Corning Products make the things you build look better, last longer, cost less



example: PC 4x12 Glass Blocks to add new eye appeal to the functional benefits of the daylight wall

Strong eye appeal has taken its place beside function as an important requirement in plant and office building design. That trend has called for new flexibility of materials—to add visual vitality to basic function. That is what the PC 4 x 12 is all about.

Here—in a striking dimensional variation of the PC Glass Block—you gain almost limitless capacity to inject new visual vitality into the daylight wall. Take for example the wall design displayed above. Creative interpretation of the light transmitting wall presents an attractive contemporary flair without sacrificing the basic value of functional use of transmitted light.

The PC 4 x 12 represents Pittsburgh Corning's constant attention to your growing need for materials which free design from purely mechanical construction. (*Continued*)

Take advantage of the coupon on page three of this advertisement.

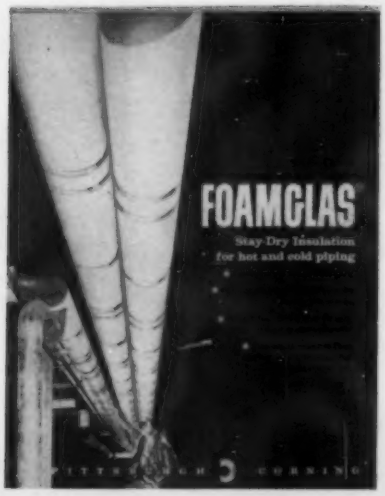
PITTSBURGH PC CORNING

example: FOAMGLAS® Stay-Dry Pipe Insulation to design five important benefits into all building service lines

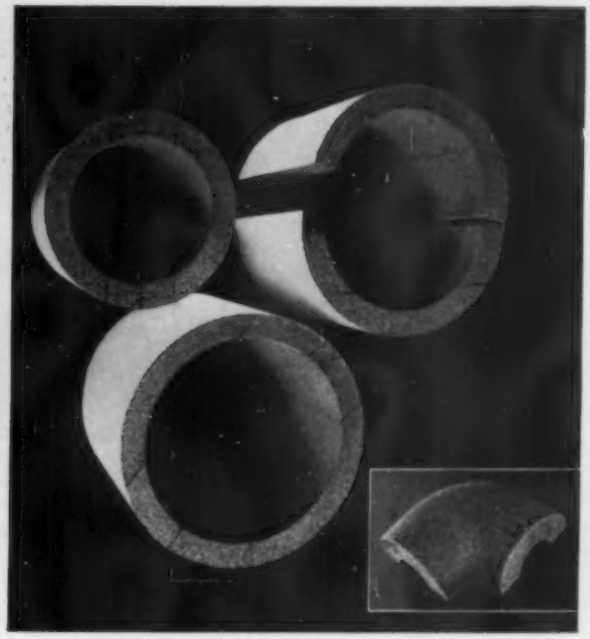
Insulation for building service lines—iced water, chilled water, low pressure steam or dual temperature—has frequently proved a maintenance headache. Now you can design away that headache with FOAMGLAS Stay-Dry Pipe Insulation and its combination of five critical benefits. First, since FOAMGLAS is incombustible and the jacket self-extinguishing, FOAMGLAS Stay-Dry Pipe Insulation substantially reduces fire hazards. Second, constant insulating value results from the absolute imperviousness of FOAMGLAS to all moisture. Separate vapor seals are unnecessary.

Next is the elimination of all weak spots in piping runs. The extraordinary compressive strength of FOAMGLAS prevents slump or sag on the highest vertical runs and saddle supports can never puncture the insulation. Fourth, the insulation is furnished with a factory applied Kraft-foil jacket. And fifth, all these benefits can be applied to total piping systems since FOAMGLAS Stay-Dry Pipe Insulation is available in sizes from ½″ copper tubing to 12″ IPS with fitting covers and elbows to match.

PITTSBURGH CORNING



Check the appropriate box on the coupon to obtain this brand new catalog containing complete specification and installation data on FOAMGLAS Stay-Dry Pipe Insulation.



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Dept. PE-100, One Gateway Center, Pittsburgh 22, Pa.

Please send me descriptive literature on the products checked below.

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- ☐ FOAMGLAS Low Temperature Insulation
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- ☐ FOAMGLAS Stay-Dry Pipe Insulation for Building Service Lines
- ☐ FOAMGLAS Insulation for Curtain Wall Panels
- ☐ PC GLASS BLOCKS
- ☐ The PC 4 x 12 Block
- ☐ PC Color Glass Blocks
- ☐ FOAMSIL,® the Acid-proof Insulating Refractory
- ☐ PC Sculptured Glass Modules

Name _____

Company _____ Title _____

Address _____

City _____ Zone _____ State _____

For more facts circle 580 on Reply Card

Invincible draws sand from conveyor trench into primary tank.

Reduces Conveyor Cleaning Costs 83⅓%

Special vented nozzle easily fits beneath conveyor pan.

This Invincible vacuum system has paid for itself in savings in less than one year. Used at Ohio Products Company to clean up spillage from the mold sand conveyor, it:

- Does the job in 4 hours instead of the 16 per week formerly required.
- Eliminates weekend work at time-and-a-half pay, thus saving the equivalent of 20 hours in weekly wages.
- Assures uninterrupted conveyor operation at this Orrville, Ohio, foundry of The Ohio Injector Company.

After castings have been made, mold sand is dumped from flasks through a grate onto a vibrating pan conveyor in a covered trench. Sand spills over the sides of the conveyor, collecting underneath the pan and along the sides of the 180-foot trench. If allowed to build up, it can impair, or halt, conveyor operation.

Before Invincible: Every Saturday, workers removed flooring over sections of the trench and used small shovels to scoop up the sand. This took 16 man-hours (equivalent to 24 hours of wages), yet it was impossible to do a thorough job.

With Invincible: Night-shift worker lets Invincible do the work. Powerful suction draws sand from beneath conveyor pan and other hard-to-get-at spots. Complete cleaning eliminates a possible cause of conveyor failure, and the job takes only 4 hours. In addition, the Invincible is used for general cleaning, thereby further reducing maintenance costs.

Check the Many Uses for Invincibles. Send for new "Invincible Vacuum Equipment" folder. It describes many cost-saving applications.

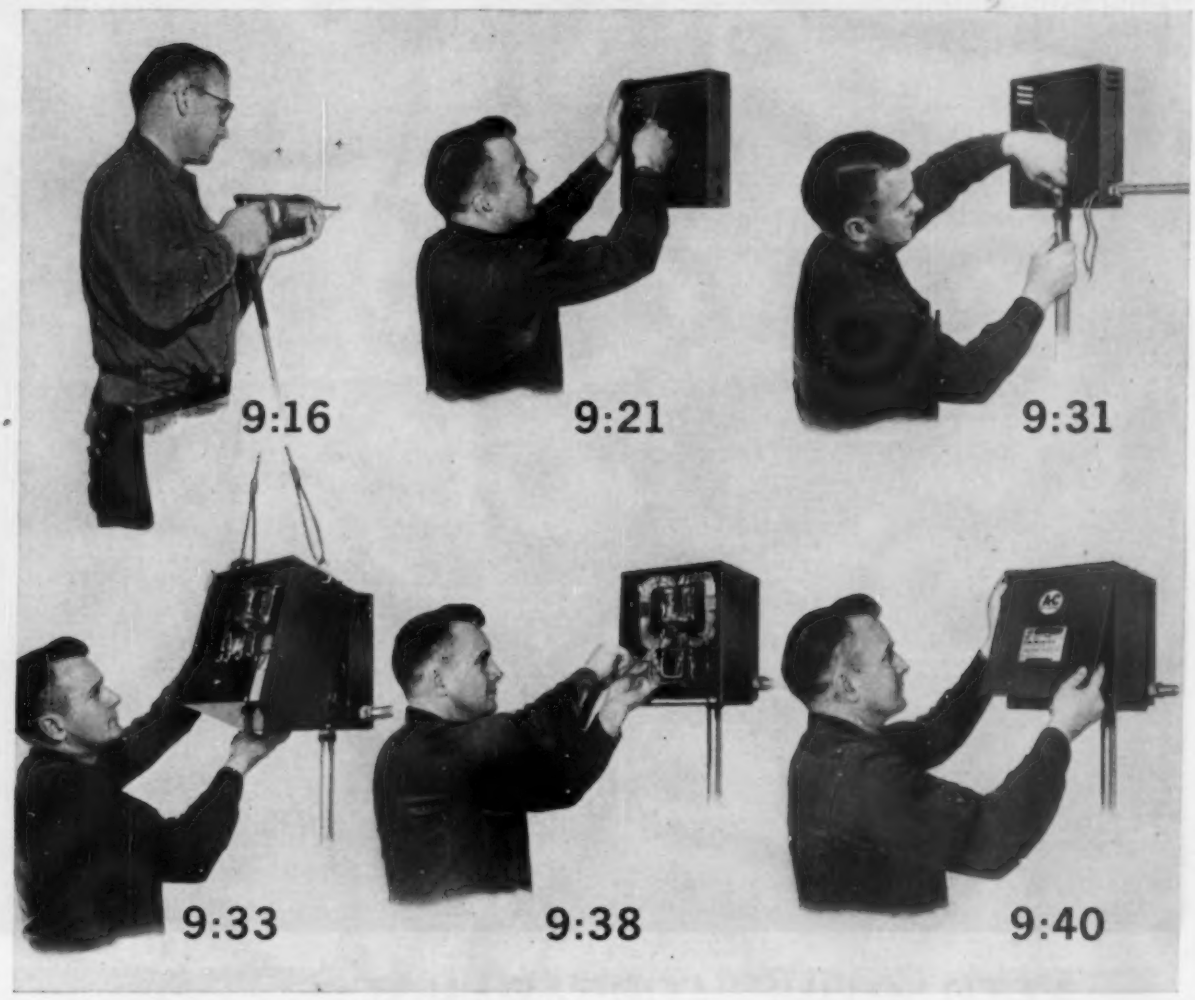
INVINCIBLE

vacuum cleaner manufacturing co., Dover, Ohio

For more facts circle 581 on Reply Card

ALLIS-CHALMERS

A-1360



9:16 — 16 minutes to drill 4 holes in concrete wall and add lead inserts to receive screws. **9:21** — 5 minutes to mount back panel to wall. **9:31** — 10 minutes to punch out knockouts and attach conduit. **9:33** — 2 minutes to put center case section in place and tighten side screws. **9:38** — 5 minutes to pull cables and connect to terminals. **9:40** — 2 minutes to fasten front panel to center section with side screws. **Installing time: 40 minutes instead of the usual hour and a half!**

35% smaller, lighter, new whisper-quiet dry-type transformers

cut installing time in half!

New A-C design eliminates common installation problems! Unique 3-piece case makes handling, wiring go like clockwork. 35% smaller and lighter, you can install them in 40 minutes instead of the usual 90 minutes.

And they're whisper-quiet. Every known factor in subduing noise has been incorporated . . . core impregnation, core and coil assembly suspension isolated from case . . . plus use of nonresonate casing. Exclusive *Curvacore* construction lowers exciting current, core losses.

This new 600-volt class indoor dry-type transformer line is available in sizes 3 to 50 kva . . . for on-the-site load center applications where critical voltage must be maintained.

See your nearby A-C office for details or contact **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.* Curvacore is an Allis-Chalmers trademark.

For more facts circle 582 on Reply Card

ATTRACTIVE APPEARANCE . . . SUPERIOR PERFORMANCE

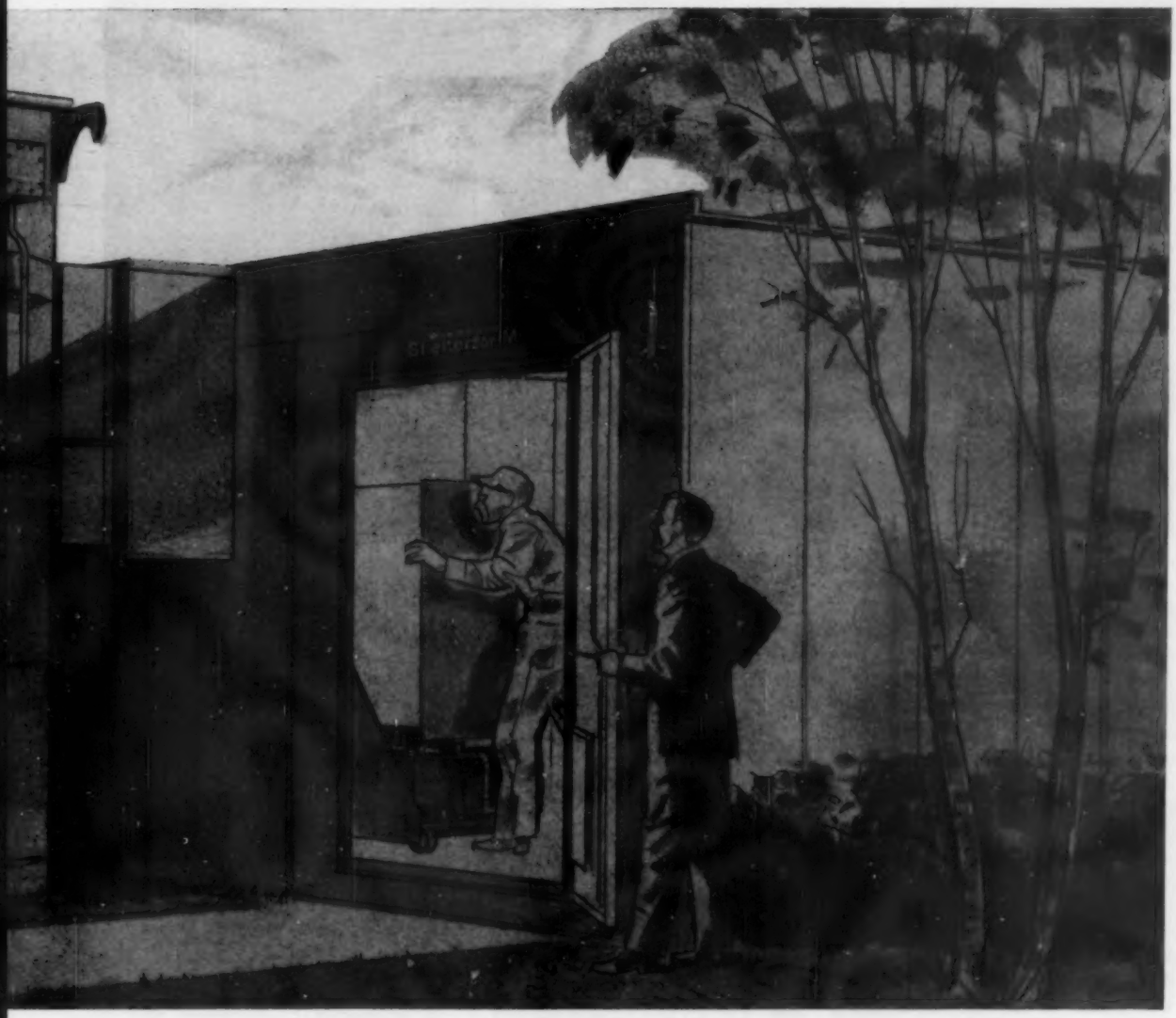
With Westinghouse unit substations, you always get ace-high performance. Switchgear and transformer are engineered as a unit—to work together for reliable, trouble-free service.

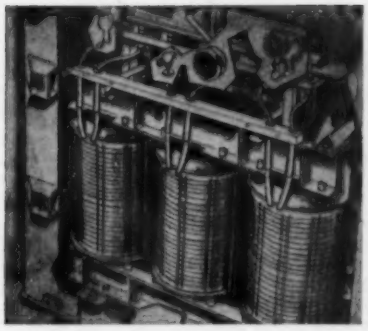
In addition, these quiet substations are good looking. Adaptable to small land plots, they are "good neighbors" in residential, commercial and industrial areas. Safe, too. Metal-enclosed construction keeps out unauthorized personnel, protects against external hazards.

Installation is simple. Westinghouse unit substations are factory-coordinated, eliminating installation complications. They are shipped in sections . . . require only bolting together and connection of incoming and outgoing lines.

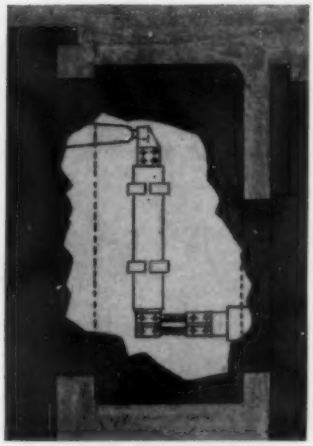
Call your nearest Westinghouse representative for all the facts . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse.

Westinghouse





TRANSFORMER FEATURES: *New Super Insuldur® Insulation System* enables transformer to handle 12% more kva load with no reduction in normal service life. • *Hipersil® Core* carries 1/3 more flux than ordinary electrical steel per unit area. • *De-energized Tap Changer* makes matching of line voltages quick and convenient when transformer is de-energized. • *Impulse Coordinated.*



BOX-TYPE THROAT CONNECTION includes provision to compensate for minor misalignment between transformer and switchgear as a result of foundation differences.

SWITCHGEAR FEATURES: *DH Magnetic Air Circuit Breakers,* with De-ion® arc interruption, assure superior circuit protection. • *Horizontal Drawout DH Breakers* permit ease of inspection, maintenance and breaker interchange. • *Limitrak® Insulation System* provides balanced insulation protection with superior nontracking characteristics. • *Shelterfor-M® Design* furnishes roomy, protected aisle space for personnel and equipment for inspections, maintenance or breaker interchange under all weather conditions.

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For more facts circle 583 on Reply Card

Fig. 1. Tester, connected to dolomite-charging machine, is designed to give pressure, temperature, and flow indications.

TESTER CHECKS HYDRAULIC CIRCUITS As System Components Remain in Place

A LIGHTWEIGHT portable hydraulic testing device has been put to use at the Homestead Works of the United States Steel Corp. as a "troubleshooter" on hydraulically operated machinery. Weighing less than 20 lb, the tester was recently connected to a dolomite-charging unit in the open hearth department in one of a series of power checks on equipment.

The instrument checked flow, temperature, and pressure relating to each of the systems without removal of any components. These tests are similar to exhaustive predelivery checks made by the manufacturing firm which is now equipping its line of dolomite-charging machines with standard connections for the tester made by the Schroeder Brothers Corporation.

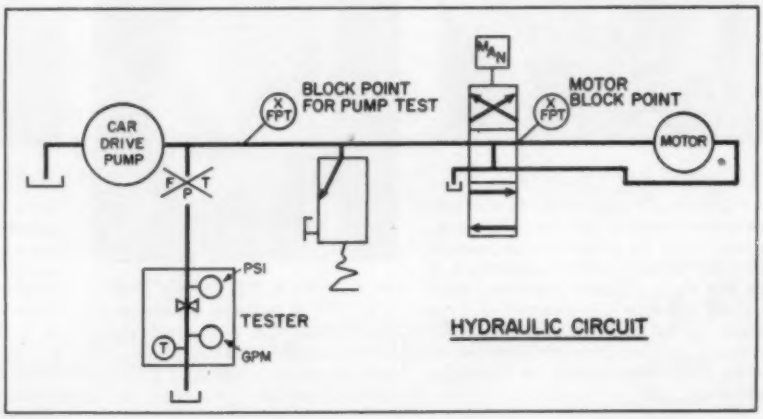
The dolomite-charging machine has three hydraulic circuits operating from a common power unit and reservoir. Two identical circuits drive the car wheels and the third turns the dolomite-throwing motor.

Maintenance men at Homestead, checking on proper power level and operating temperature, connected the tester to full-flow tees located between the pump and relief valves of the three circuits to run the following tests:

With the tester pressure port connected to the tee and the return port connected to the top of the reservoir, the left car wheel circuit was checked by blocking the flow to the fluid motor with a pipe cap. This isolated the motor from the circuit. Then, by shifting the control valve to operating position, the total gallons per minute output was directed through the tester. A similar test was run on the right car drive circuit to check flow at working pressure.

Readings on the gages indicate low and operating pressures. Reservoir oil level and strainers are checked also to determine normal operation. The tester eliminates "hit and miss" component replacements, and returns the productive equipment to service with a minimum of downtime. **End**

Fig. 2. Tester gets full flow by blocking outlet to motor and by shifting valve.



Why Use D-C OPERATING COILS IN A-C STARTERS?

Large a-c motor starters frequently use d-c operating coils even though this requires the addition of rectifying equipment. Author reviews characteristics of both a-c and d-c magnets to show d-c is best choice in this application

By A. E. HERMAN, Application Engineer, Control Department, Allis-Chalmers Mfg. Company, Milwaukee, Wis.

ALTERNATING current and direct current operating magnets for controllers are similar in general appearance in that each contains a stationary member or frame, a movable member or armature and an operating coil. This, however, is where the similarity ends.

A-c magnets, Fig. 1, are readily identified since they are built up from laminated sheets of steel and are secured by a number of rivets. On the other hand, d-c magnets, Fig. 2, are fabricated from solid iron structures.

The above must be classified as general information, however, since in small relay magnets, it is sometimes possible to use a solid structure for an a-c magnet. Conversely, for high speed d-c magnets, it is possible to use a laminated structure if economics permit. A very definite distinguishing characteristic of an a-c magnet is the shading coil. This is a one-turn coil, usually of solid copper, which is imbedded into a portion of the pole face in the magnet frame. The purpose of this shading coil is to prevent the armature from dropping out when the a-c current passes through zero, a condition which occurs 120 times per second in a 60-cycle power supply. This coil is so located and proportioned, that a pre-determined amount of flux in the magnet will induce a current in the coil.

Induced current in the shading coil will set up a flux which is displaced from the normal magnet flux. This displaced flux does not pass through zero at the same time as the normal flux does and, therefore, helps to hold the armature closed through the normal current zero.

Another difference that can readily be noted between a-c and d-c magnets is their noise qualities. Due to their oscillating power condition, a-c magnets always have a distinctive hum. Since d-c power is not oscillatory in nature, d-c magnets do not require shading coils and are quiet in operation.

A-c magnets are built up from laminated alloy steels, to reduce the eddy current losses, and are riveted together. It is extremely important that these laminations be properly secured or they will shift in operation. If the armature and frame pole

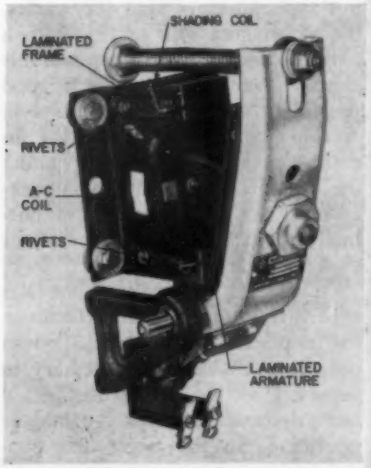


Fig. 1. Shading coil, laminated armature and frame are identifying characteristics of the a-c magnet.

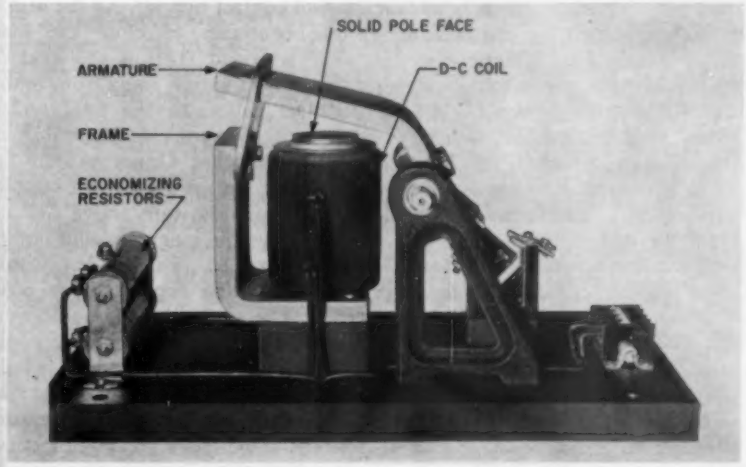
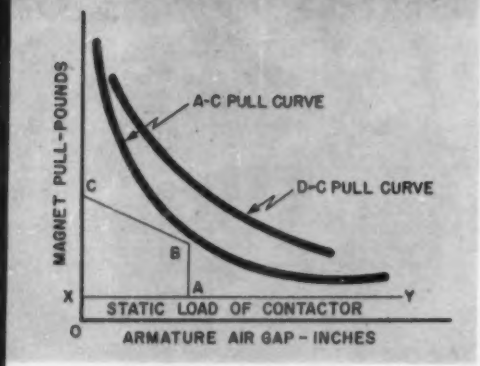


Fig. 2. Solid pole face, armature and frame distinguish d-c operating magnet from a-c magnet. Resistors are frequently used in series with d-c coil to improve drop-out characteristics. Contact shorts out resistors during closing.



D-C OPERATING COILS

faces do not match, due to lamination shifting, the magnet will become exceedingly noisy in operation. This condition holds true for anything which will prevent proper matching of the pole faces, such as dirt or corrosion.

Insofar as the coil current is limited by the air gap and reactance, it means that any foreign particles on the pole faces which will not allow the armature to make a good seal will also cause a higher than normal sealed current. This higher coil current can cause the insulation to deteriorate, due to high heating, with a consequent coil failure.

Gradual deterioration of the coil may occur in days, weeks or even months. Repeated coil failures are often due to this condition. This condition can also develop from many closing operations. The impact of the armature closing has a tendency to damage the machined pole faces and mis-alignment on the pole faces occurs.

When designing a-c magnets, it is important that the rivets be correctly positioned. They must be placed so that the normal magnet flux cannot pass between a pair of them. If this condition should exist, the pair of rivets will function as a one turn, shorted, secondary winding of a transformer and considerable heat will be generated.

The a-c magnet is basically a motor of limited rotations and has about the same starting characteristics. That is, in the open armature position, the coil draws a high inrush current similar to that of a motor. This inrush current is several times the sealed armature coil current. With open armature gap, the coil current is limited only by the reactance of the coil and the power supply must be able to supply the high current required.

D-c magnets do not experience these difficulties. Coil current is limited by coil resistance, regardless of the armature air gap. The magnet is always quiet, and life expectancy is considerably higher.

A-c magnets are usually sensitive to voltage. Any voltage drop normally beyond 85 per cent of rated coil value will cause the magnet to become noisy and draw above normal current. In some cases the magnet may actually drop its load if the voltage is reduced much below 85 per cent of the rated value.

Relatively insensitive to a voltage drop, d-c magnets can readily be made to pick up the load at 65 per cent voltage and drop the load at less than 25 per cent voltage.

Pull force, for the same pole area, is almost twice as great on d-c magnets as compared to a-c magnets. Normally the pull characteristic of an a-c magnet has a sharper bend at the knee compared to the flatter curve of the d-c magnets, Fig. 3. The value x-y is the static load on the magnet and includes the weights of the armature and the movable contact assembly.

Comparing Pull Curves

When the magnet is energized the armature attempts to go to zero air gap. At a predetermined air gap point A, the contacts touch and a sudden load, A-B, is added. This sudden load is the initial contact pressure and is required to prevent initial contact bounce. As the armature continues to close the load B-C is added. This is the load of the contact spring going from initial contact touch, to the final sealed contact pressure. Mechanical load on the magnet cannot exceed the magnetic pull curve. For example, if the point B were above the a-c pull curve the magnet would not go to the sealed position but would remain at the contact touch position. The a-c coil would be drawing above normal current and could burn out. In addition, one would be carrying power current on the contactor tips at touch pressure which could cause welding or burning of the tips. The former condition would not occur with a d-c magnet.

Any change in voltage, a-c or d-c will affect the pull curve. If the voltage should drop, the pull would also drop and the curve could fall below the C-B value causing the magnet to hang up. The sharper knee bend of an a-c pull curve makes this condition somewhat more critical, compared to the d-c curve.

It is noted that the rate of change after contact touch is greater for the a-c curve. This indicates a higher rate of acceleration of the armature and the movable contact assembly as compared to the d-c and could lead to closing contact bounce with possible welding of the tips.

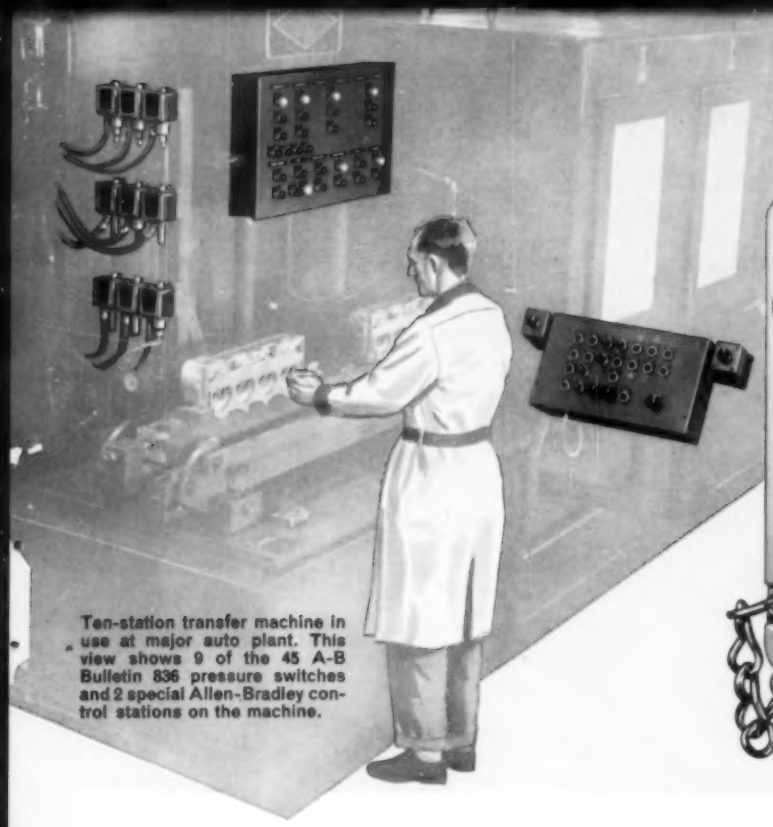
In the larger size magnets, size 5 starters and up, for instance, the use of an a-c magnet is normally unsatisfactory. The closing inrush currents would cause a considerable "bump" on the power supply and may be of such magnitude as to call for a larger transformer supply. The closing inrush could affect other equipment on the same power supply. Due to the pull characteristics of the magnet and the weight of the large armature, the closing inertia becomes high. This high closing inertia may be sufficient to cause bounce or welding of contact tips.

Although slower in operation, d-c magnets do not have these detrimental characteristics and are much more satisfactory for high loads. The d-c power supply, if not readily available, can be furnished by full wave rectifiers mounted right on the starter panel.

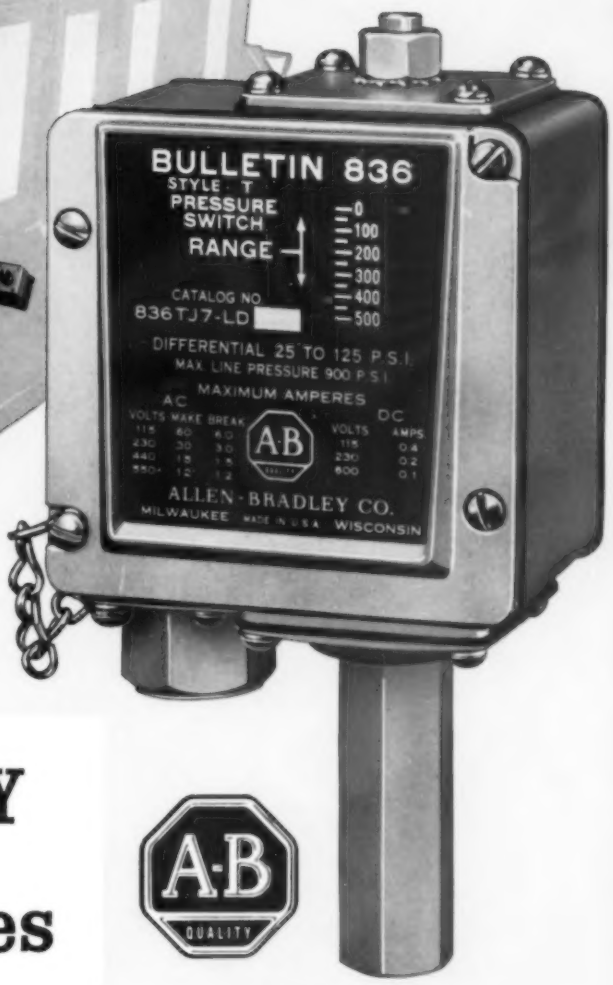
Another factor to consider is the rate of operation of the magnet. For applications of high duty cycles, the a-c magnet with its high inrush currents could develop considerable excessive coil heating with a good possibility of burning out the coil. A d-c magnet, having no real inrush current could operate under the same duty cycle without exceeding the temperature rise normally experienced by continuous closed operation.

In general, d-c magnets are less expensive to manufacture. However, for applications where a-c power only is available it is necessary to supply a rectifier and sometimes a control transformer for d-c magnet operation. In the larger size controllers this additional cost factor is not as critical and rectified d-c units can be supplied. **End**

For more facts circle 584 on Reply Card——→



Ten-station transfer machine in use at major auto plant. This view shows 9 of the 45 A-B Bulletin 836 pressure switches and 2 special Allen-Bradley control stations on the machine.



ALLEN-BRADLEY

OILTIGHT

Pressure Switches

provide consistent accuracy and maximum reliability

Bulletin 836 Style T
Oiltight Pressure Switch

These rugged Allen-Bradley Bulletin 836 Style T oiltight pressure switches are specifically designed to take the punishment of hard, day-in and day-out industrial use. The die-cast aluminum housing is completely sealed. Oil cannot get in and foul the contacts—even when it flows over the enclosure in a continuous stream. The precision switch mechanism insures extreme accuracy of repeatability. An extremely important feature lies in the "snap action" of this switch—it maintains its normal contact pressure up to the instant of switchover—regardless of how slowly the trip point is approached. Contact chatter—which means unreliable operation—is impossible, and contact life is greatly increased. The contact block has two isolated circuits with one N.O. and one N.C. set of contacts.

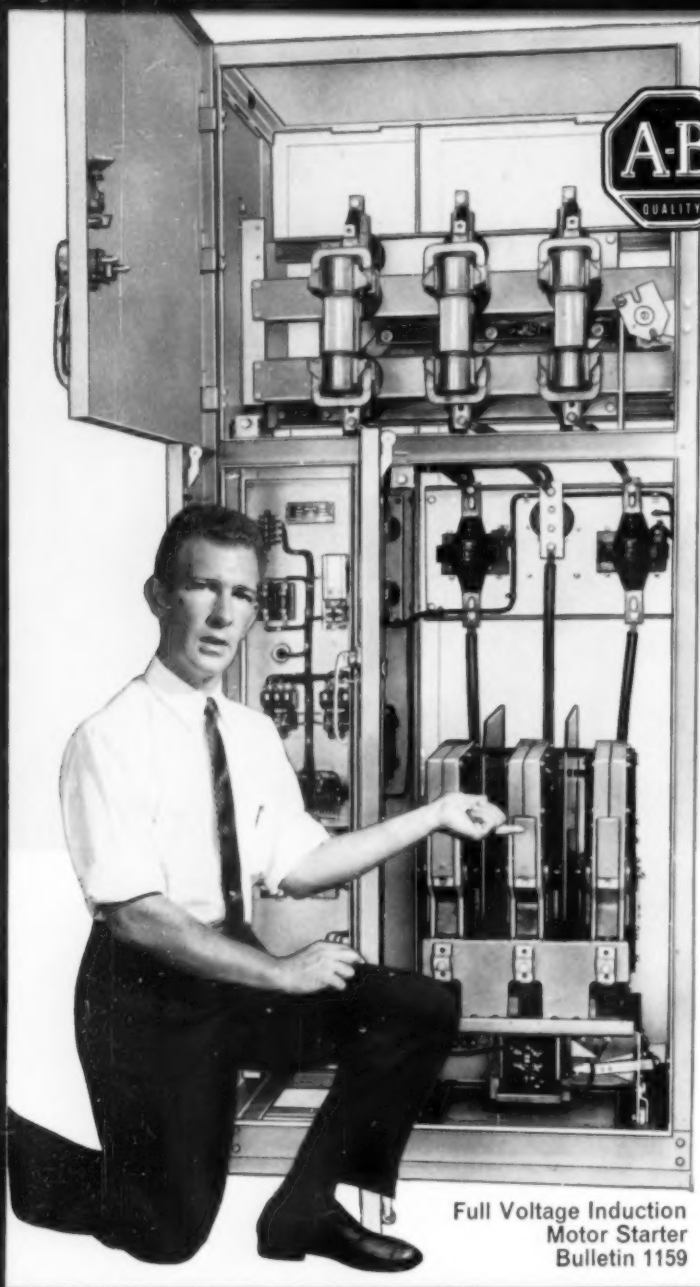
Both the operating pressure and the differential are adjustable. The pressure is externally adjustable with the setting shown on a calibrated scale, and a trip indicator shows the operating point. These A-B *quality* controls are made for operating at pressures up to 5000 psi. Write for full details.

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis. • In Canada: Allen-Bradley Canada Ltd., Galt, Ontario



Full Voltage Induction
Motor Starter
Bulletin 1159

The only HIGH VOLTAGE STARTERS

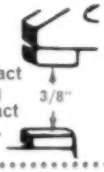
built to provide millions of trouble free operations

An astounding claim but true! The secret of this remarkable operating life of Allen-Bradley high voltage air break starters is found in the extremely short contact travel—*it's only 3/8"*. Thus, pounding and contact wear are reduced to a minimum. In addition, contactors in A-B high voltage starters have only ONE moving part. It's the same simple solenoid design that has proved good for millions of trouble free operations in A-B low voltage starters. And like A-B low voltage starters, the double break, silver alloy contacts never need maintenance. For complete details on Allen-Bradley high voltage starters, send for Publication 6080.

FEATURES OF THE ALLEN-BRADLEY RUGGED SOLENOID AIR BREAK CONTACTOR

ONE MOVING PART
All trouble-causing pivots, pins, and flexible jumpers are eliminated.

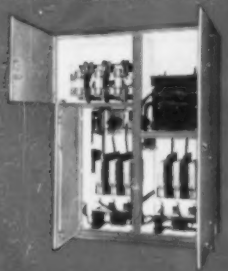
CONTACT TRAVEL ONLY 3/8"
Reduced impact and pounding extends contact operating life.



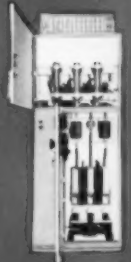
DOUBLE BREAK CONTACTS
of silver alloy completely eliminate the need for contact maintenance.

FAST ARC SUPPRESSION
New blowout design, new arc chutes molded of arc resistant material.

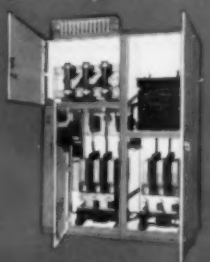
ALLEN-BRADLEY HIGH VOLTAGE STARTERS ARE MADE FOR ALL TYPES OF MOTORS AND ALL TYPES OF SERVICE



Reduced Voltage
Induction Motor Starter
Bulletin 1172



Full Voltage
Synchronous Motor Starter
Bulletin 966



Reduced Voltage
Synchronous Motor Starter
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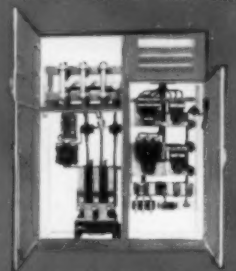

Wound Rotor Motor Starter
Bulletin 1180

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YOUR INVITATION TO ATTEND

Theme of Conference

PLANNING • DESIGN • MAINTENANCE

PLANT ENGINEERS have always been responsible for maintenance of industrial plant and office lighting systems. They know that long term maintenance costs of lighting systems depend a great deal on the quality of the original installation.

Recognizing the need for basic information on industrial lighting, PLANT ENGINEERING and the Chicago Lighting Institute have worked together to present a one-day conference designed to provide solutions to your lighting problems. Both practical plant engineers and lighting specialists will speak at the Conference.

To establish a firm foundation upon which attendees can build their lighting knowledge, the first speaker will discuss "Illumination Levels for Industrial Tasks." Presented by Benjamin F. Avery, District Engineer, Large Lamp Department, General Electric Company, this talk will briefly cover the tremendous amount of scientific research conducted in major colleges and universities to determine the amount of light needed for various industrial tasks.

The new IES Illumination Standards (1959) are based on this academic work. A reprint of this standard will be included in your conference kit so that you can look up recommended footcandle levels for tasks common to your plant.

Once you have established a practical footcandle level for your operations, the next logical question is "What kind of light source should I use?" Raymond E. Wozniak, Illumination Engineer, Chicago Lighting Institute, will outline methods to simplify this problem in his talk "Choice of Light Sources."

Now you are ready to make some actual lighting calculations, and Richard M. Hall, Lighting Engineer, Wheeler-Fullerton, Lighting Division, will show you how to determine the number of fixtures and lamps needed to provide a given lighting level. Sample calculations will be in your conference kit so you can review this important information.

William Johnson, Lighting Division, Westinghouse Electric Corporation, is flying in from Cleveland to tell you about some of the special problems involved in lighting low and high bay areas. A. E. Roberts, Maintenance Engineer, General Motors Technical Center, and author of "Methods and Procedures for Lighting System Maintenance," published in the March, 1960 issue of PLANT ENGINEERING will give you a first-hand account of his experiences in "Maintaining the Lighting System".

Lighting in hazardous locations will be discussed by Benjamin S. Benson, Director of Research & Development, Benjamin Division, Thomas Industries, Inc. Herman E. Sereika, Lighting Consultant, Chicago Lighting Institute, will demonstrate special techniques used to simplify inspection tasks. Lighting employees parking lots and building floodlighting for company identification, prestige and protection will be presented by Burton Benjamin, Revere Electric Mfg. Company.

To help you sell better lighting to your management, Edward G. Arsnow, Plant Engineering, Western Electric Company, Inc., is coming in from North Andover, Massachusetts, to tell you about the "Benefits Derived from Good Lighting". By placing emphasis on management and the employee viewpoint, you may pick up ideas that will help you sell these benefits in your plant.

PLAN NOW TO ATTEND

Conference starts at 9:00 a. m.
Registration Fee $5.00

For additional information write to: Editor, PLANT ENGINEERING, 308 E. James St., Barrington, Illinois, or call Vern Kempf, Electrical Editor, Dunkirk 1-1840 (Barrington). **End**

How to Plan INDUSTRIAL LIGHTING

By WILLARD ALLPHIN, Illumination Research, Sylvania Lighting Products, Salem, Mass.

PART II OF A SERIES

INCANDESCENT lamps today are made in sizes from a small fraction of one watt to 10,000 watts, but the plant engineer is concerned mainly with sizes from 100 to 500 watts.

Where ordinary incandescent lamps do not stand up well under jolting and vibration, rough service or vibration lamps may be indicated. It is important to distinguish between the various types of rough treatment. Shocks and blows such as are received by trouble lamps on extension cords, and jolts transmitted to lamps mounted on punch presses call for rough service lamps. Vibrations of fairly high frequency, such as from industrial sewing machines, call for vibration lamps.

One feature common to the 100-watt vibration lamp and 100-, 150- and 200-watt rough service lamps is the arbor wire shown in Figures 6 and 7. This is made of piano wire and cushions the filament against shocks and vibration. The rough service lamp has extra filament supports and lead-in supports. The extra supports diminish the possibility of the filament breaking under a blow, but they also reduce the efficiency of the lamp because of the cool spot which occurs at each point where a support touches the filament.

The filament of the vibration lamp is more flexible so that it will sag when subjected to vibration, but will not break so easily as will non-sag wire. Although extra filament supports are also used in the vibration lamp, it should not be burned in a horizontal position because portions of the filament might sag enough to short circuit part of its length.

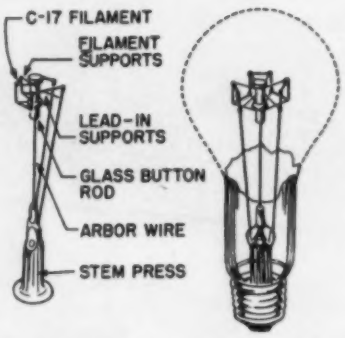


Fig. 6. Typical rough-service lamp has extra filament and lead-in supports.

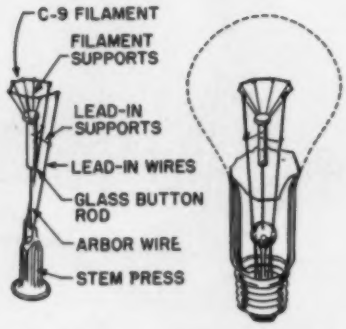


Fig. 7. Filament of vibration-service lamp is more flexible to resist breakage.

Performance of incandescent lamps depends markedly on the applied voltage, Fig. 8. Note that the scale for per cent life is on the right hand side of the chart, whereas the scale for the other characteristics is on the left.

As an example, suppose a 115-volt, 200-watt lamp is operated on a 120-volt circuit. This means the applied voltage is 104 per cent of rated. From Fig. 8, the lumen output will be 116 per cent of rated. Wattage will be 107 per cent of rated, or 214 watts and life will be only 57 per cent of rated, or 430 hours for a 750-hour lamp.

For lamps operated under voltage, the characteristics change in the opposite direction. For example, a lamp operated at 95 per cent of rated voltage would have a life of 200 per cent of rated, but its lumen output would be only 84 per cent of rated.

There is no magic in the design of an incandescent lamp for proper life and efficiency. When the life goes up, the efficiency goes down, and vice versa. Rated lives of 750 and 1000 hours strike an economic balance between lamp costs and operating costs for most applications. However, there are cases where it is wise to change the ratios. A pilot lamp may be designed to last for several thousand hours because it is used only as an indicator, and its light output is not important. A No. 1 photoflood lamp, on the other hand, is designed to last for only three hours, in order to get a very high light output.

"Long-life" lamps are sometimes offered with claims of very long life. Often a premium price is charged. For most applications it is sensible to operate at 750 to 1000 hours life, in order to get proper efficiency. Where incandescent lamps must be operated in locations difficult of access, where replacement labor costs are high, "extended service" lamps are available. These operate in the same way as standard lamps operated somewhat under voltage, but

the filaments are designed so as to draw rated wattage. Certain sizes from 25 to 1000 watts are available as extended life lamps at a rated life of 2500 hours.

Incandescent lamp characteristics as they change throughout the life of the lamp are given in Fig. 9, and the life expectancy is shown in Fig. 10. When the rated life of a lamp is given as 1000 hours, it does not mean that every lamp will fail after exactly 1000 hours operation, even on rated voltage. In a large batch of lamps a few will fail early, and some will last much longer than the average.

The curve in Fig. 10 predicts the mortality of a large batch of incandescent lamps. Note that at rated life slightly more than half of the lamps will still be burning. The fact that a few lamps will last much longer than rated life does not mean that it is economical to keep them in service.

Bulb blackening reduces the lumens and the lumens per watt, Fig. 9. In large installations, lamps are often replaced in large groups before they burn out, in order to save the labor cost of one-at-a-time replacement. Group replacement will be mentioned again in regard to fluorescent lamps.

Where more than a minimum of footcandles are required and where hours of burning are fairly long the considerably greater efficiency of fluorescent lamps gives them precedence over incandescent lamps.

If lamp life seems short, the first question is whether enough lamps have been studied to provide a true picture. As seen in Fig. 10, an occasional lamp will fail early. If records kept on batches of 100 or more lamps show that average life is actually shorter than rated, it may be that the lamps are being operated over voltage. Plugging a voltmeter into a socket momentarily will not establish this, because the voltage may be higher at some times of day than at others. A recording voltmeter should be used to get the true picture.

If the operating voltage is satisfactory, and the bulbs do not show the amount of blackening expected after normal life, the engineer should look for shock or vibration conditions which would call for the use of rough service or vibration lamps.

A broken high-wattage lamp where the glass has discolored to a blue-black color or to a color approaching yellow can mean that the lamp was exposed to a drop of water or a piece of cold metal. Lamps with heat-resistant glass should be used in exposed locations or outdoors, except where low-wattage vacuum lamps are involved.

When the inner surface of a failed lamp is covered with a white powder, the lamp is called a leaker. The usual cause is a very tiny air leak which did not admit enough air to prevent the lamp from lighting when first inspected.

The fluorescent lamp depends for its action on an arc operating in an atmosphere of argon and mercury vapor. The arc produces most of its radiant energy at invisible wavelengths, but the fluorescent powders or phosphors inside the tube convert this energy to visible light.

An arc of this type has less and less resistance as more and more current passes through it, so if placed directly across the line, it would "run away" and destroy the lamp. Therefore, a current-limiting device, usually a choke coil, must be used in series with the lamp. Furthermore, a voltage of 110 to 120 is not sufficient to start fluorescent lamps in the larger sizes, so the ballasts for these must also include a transformer, usually an autotransformer.

In lead-lag ballasts, where one lamp is operated out of phase with the other, there is also a condenser for the lead lamp. High power factor ballasts also use a condenser to raise the power factor.

Most fluorescent lamps in indus-

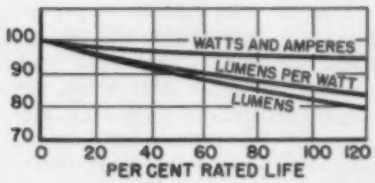


Fig. 9. Incandescent lamp characteristics as they change throughout lamp life.

Fig. 8. Performance of incandescent lamps depends upon the applied voltage. Per cent of life is shown on scale at right.

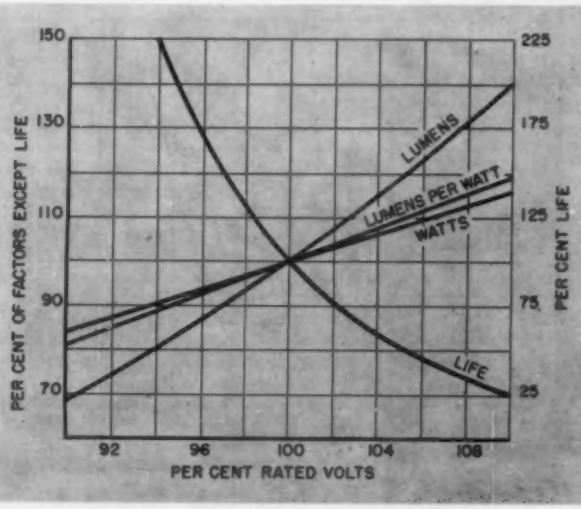
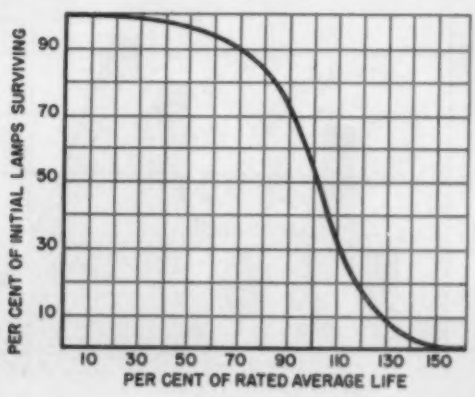


Fig. 10. Curve predicting mortality of a large batch of incandescent lamps. A few will fail early and others last longer.



try are either preheat, rapid start or instant start. The first circuit commercially available was the preheat, in which an automatic switch, called a starter, closes a circuit, causing current to flow through the cathode coils of the lamp. When the coils are heated and the gas surrounding them is ionized, the starter switch opens, and an arc strikes across the space between the cathodes. If arc fails to start, starter will try again.

Next development was the instant start lamp, in which a high voltage is supplied to start the arc without any preheating of the cathodes. Instant start ballasts are larger, heavier and more expensive than preheat ballasts.

Most recent addition has been the rapid start lamp. Extra windings in the transformer heat the cathodes continuously. Starting is not as fast as with an instant start circuit but takes no more than two seconds and usually less than one second.

Cathodes of rapid start lamps have finer wire and are generally triple coiled in order to hold more coating material. Preheat lamps, not having this construction will not operate satisfactorily on rapid start circuits, but rapid start lamps are entirely satisfactory on preheat circuits. For this reason, and because very few new fixtures are being equipped with preheat ballasts, lamp companies have recently started to supply rapid start lamps for both types of service. This has the obvious advantage of reducing inventories and avoiding mistakes where both types of circuit are used in a plant. However, there are millions of preheat ballasts still in service, so it will be necessary to deal with starters for some time to come.

Nearly all fluorescent lamps used in plant and office lighting are 1½ inches in diameter (T-12) and either 4 or 8 feet long. A 4-foot, 50-watt lamp may be preheat (of earlier manufacture), rapid start or instant start. Higher wattage 4-foot T-12 lamps are made in High Output at 60 watts, and Very High Output at 100 watts.

In the T-12 diameter, 8-foot lamps are made in instant start at 73 watts, High Output at 105 watts, or Very High Output at 200 watts. All High Output and Very High Output lamps are rapid start. Instant start lamps are also called Slimline.

Fluorescent lamp colors most commonly used in industry are daylight, cool white, white and warm white. Figure 11 shows the spectral energy distribution curve for a standard cool white fluorescent lamp. Note that in addition to the smooth curve of energy, there are larger blocks of energy at some wavelengths. These represent the "mercury lines," where visible energy from the mercury arc gets through the phosphor coating. Actually the energy occurs in much narrower bands, which if drawn to scale, would run off the page.

Figure 12 compares the spectral energy distributions of four standard fluorescent lamps, with the mercury lines omitted to avoid confusion. Note that the cooler colors have more blue radiation and less red. All standard fluorescent lamps are somewhat lacking in red radiation, as compared with natural daylight. This is not ordinarily objectionable, and many people do not notice the lack. However, there are applications where the advantages of fluorescent lighting are desired together with more accurate color rendition. Deluxe lamps, Fig. 13, provide this better color rendition at a sacrifice of from 25 to 30 per cent of total lumen output. In industrial applications, deluxe warm white lamps might be used in women's rest rooms, and deluxe cool white in production areas where fairly accurate color rendition is needed while material is in process.

Voltage differences have less effect on the operation of fluorescent lamps than on the operation of incandescent lamps, but they cannot be ignored entirely. Standard ballasts are designed for a line voltage of 118, but will operate the lamps satisfactorily over a range from 110 to 125. If the voltage is below 110, it may be difficult to start the lamp, particularly if the humidity is high.

Fig. 11. Spectral energy distribution curve for cool white fluorescent lamp. Note blocks of energy at some wavelengths.

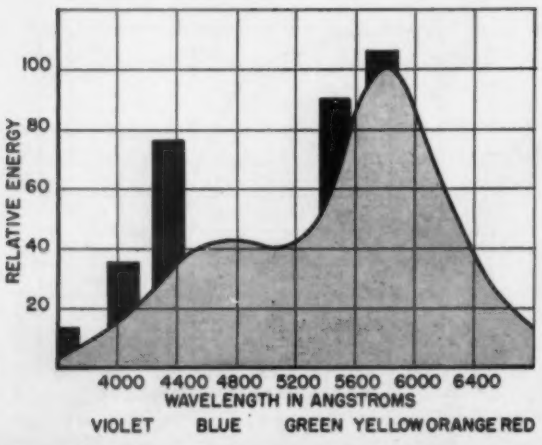


Fig. 12. S. E. D. curves for four standard fluorescent lamps. Note cooler colors have more blue radiation and less red.

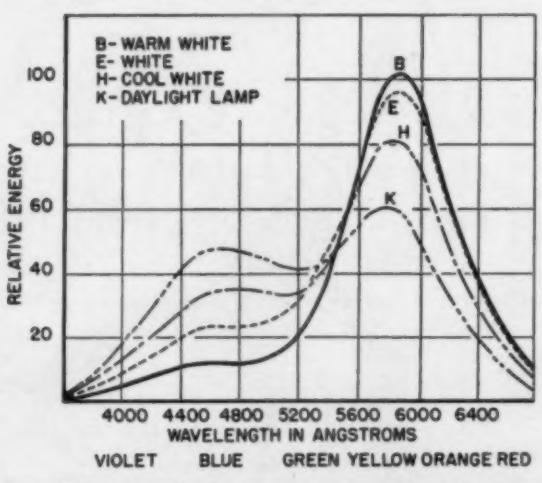


Fig. 14. Approximate effect that number of burning hours per start has on rated life of preheat lamps.

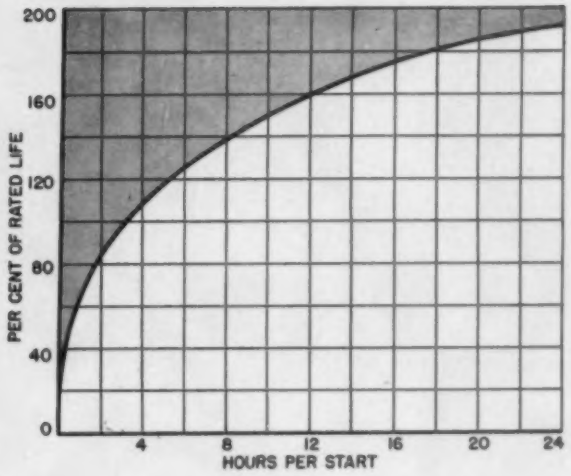
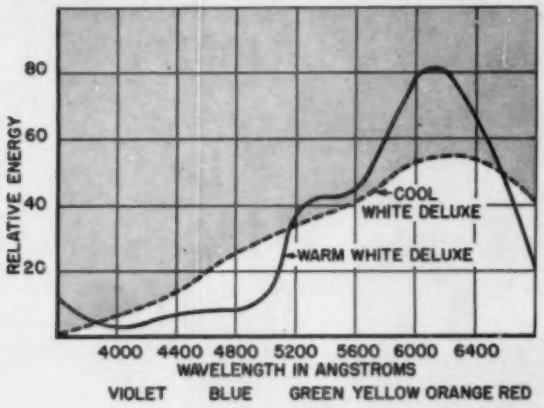


Fig. 13. Deluxe lamps provide better color rendition at a sacrifice of from 25 to 30 per cent of lumen output.



If the voltage is more than 125, the cathodes of the lamps are affected adversely.

The number of starts has an effect on the life of a fluorescent lamp because more of the cathode-coating material is used up when the lamp starts than is used in several minutes of operation. Figure 14 shows the approximate effect that number of starts has on rated life of preheat lamps. Rapid start lamps behave similarly, but instant start lamps are affected somewhat more by frequency of starting.

Output of a fluorescent lamp falls off rather rapidly in its first few hours of operation, then settles down to a slow decline throughout life. See Fig. 15.

Fluorescent lamps are like incandescent lamps, in that some will survive for less than rated life and some will last longer. Figure 16 is a typical mortality curve.

Cost of replacing individual lamps as they burn out leads some companies to replace them in groups before burn-out. The economics of a particular situation require considerable study, but some users replace lamps at 80 per cent of rated life. Others keep a count of early replacements and make the group replacement when early replacements have reached 20 per cent of all the lamps in service.

Applications of fluorescent lighting today are so general as to re-

(Continued on page 282)

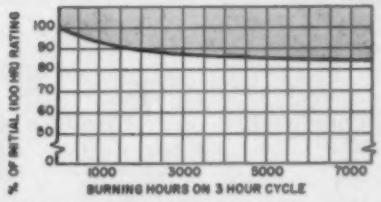


Fig. 15. Lumen output curve of fluorescent lamp shows rapid decline at start.

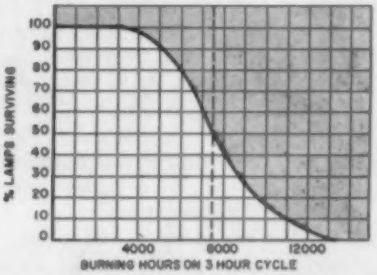
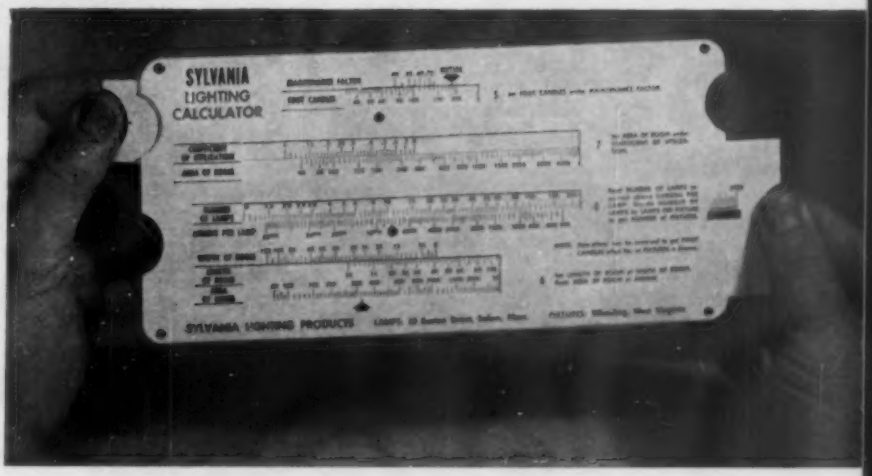


Fig. 16. Mortality curve of fluorescent lamps show that some will fail early.

Write In For Your Free Lighting Calculator

You will need this handy free lighting calculator when the author covers industrial plant and office lighting layouts in a later chapter. Write in now, so you will have it to work out the typical problems to be presented. Calculator is a simple tool for determining the number of fixtures required to meet a specification or the number of footcandles to be expected from a specific layout. It also provides a new and easy method for finding room ratios. Send single request, on company letterhead, to the Editor, Plant Engineering, 308 E. James Street, Barrington, Illinois. Individual letterhead request only, please.



LIFTING SCHOOL HITS THE ROAD

Fig. 1. Many employees from a utility firm attended a recent session of the school.

SOMETHING new in traveling schools or seminars has been winning its spurs over the country in the last two years; the "Safety in Lifting" school sponsored and produced by the Wire Rope Division of the Jones & Laughlin Steel Corporation. Normally the school is a seven-hour presentation illustrating safety in overhead lifting.

The items covered are wire rope, wire rope assemblies, chain and chain slings, manila and synthetic ropes, nylon and dacron web belt slings, woven wire slings, and some information on hoists and cranes.

Following the few initial presentations the school has been modified by continual improvement but its context has remained rather constant and the highlights are presented here.

At the beginning of the course the importance of safety is emphasized for a few moments. Three topics, namely Man, Method and Materials are mentioned and it is made known that the plant's own safety program will suffice to take care of the Man issue.

Method. Hitching techniques are demonstrated with the 8-ft aluminum two-hook crane, tiny slings, and model objects. Part of the Method approach is the showing of the effect of sling angles on sling stresses with the aid of fisherman's scales. Another school item in this category is center of gravity and its effect is shown in one and two hook turning.

Material. The lecturer first raises the level of knowledge on wire rope to a point where safety and application can be appreciated. The discussion on materials includes a dissertation on chain, fiber ropes, web belt slings, and woven wire slings. Samples of items are passed among the students and their positions in the field of lifting are defined. Standards for care, maintenance, and inspection are reviewed.

Design standpoint of hooks is explained and the errors of point loading and overloading illustrated. Also demonstrated are eye bolt dangers due to bending of the standard shanks. After the formal part of the school is completed, a general question and answer period follows.

The school has traveled thousands of miles and has been presented in many locations with instructions given to people in a variety of industries. **End**

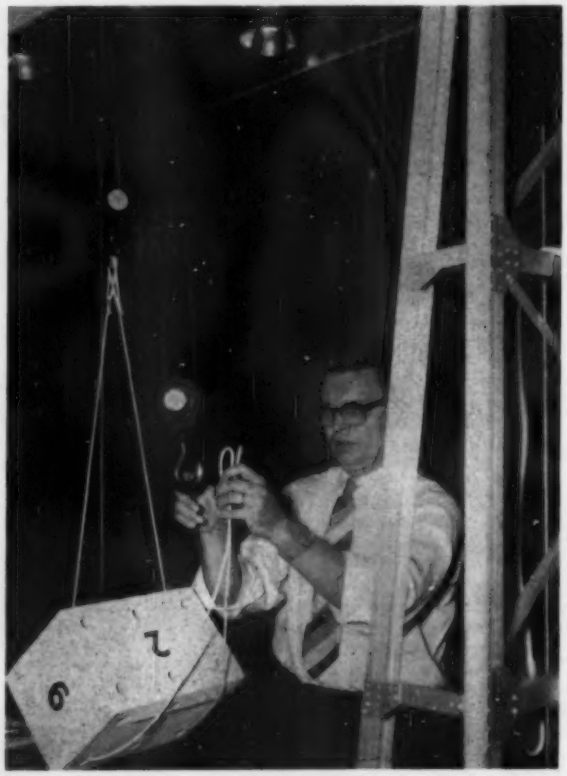
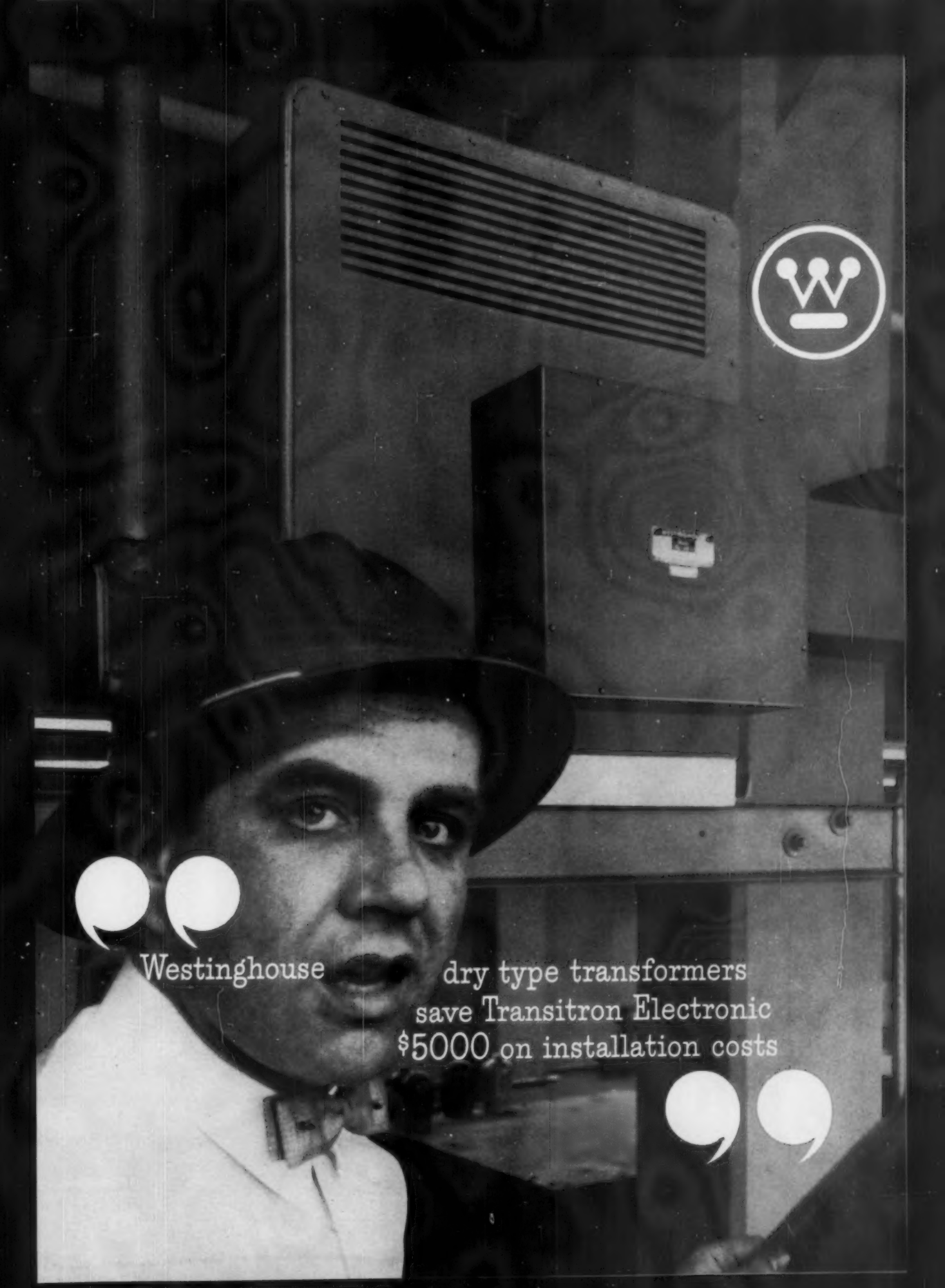
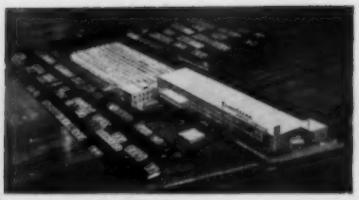


Fig. 2. William D. Meals, Chief of Product Development and Applications, is one of the J & L school's instructors.


Westinghouse
dry type transformers
save Transitron Electronic
$5000 on installation costs



"Our savings stem from the lightweight, compact size and special features of Westinghouse DT-3 Transformers"

Growing rapidly since its founding in 1952, Transitron Electronic Corporation, now operating in three plants with a total footage of over 750,000 square feet, manufactures transistors, diodes, rectifiers, voltage regulators, controlled rectifiers and 4-layer switching devices. The modern distribution system serving Transitron's new plant—a renovated textile mill—includes 10 Westinghouse DT-3, 300-kva transformers. Plant Engineer H. R. Hammond (on cover) pinpoints how they saved Transitron over $5000 on installation costs.

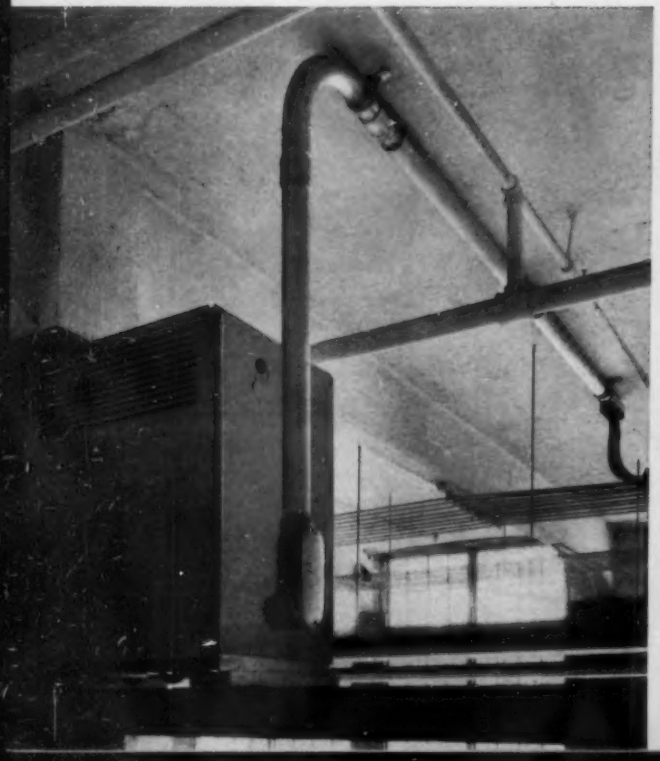
"Weighing only 1800 pounds each—about 40% less than a conventional unit—the DT-3's were mounted 10 feet off the floor on simple channel irons between building support columns.

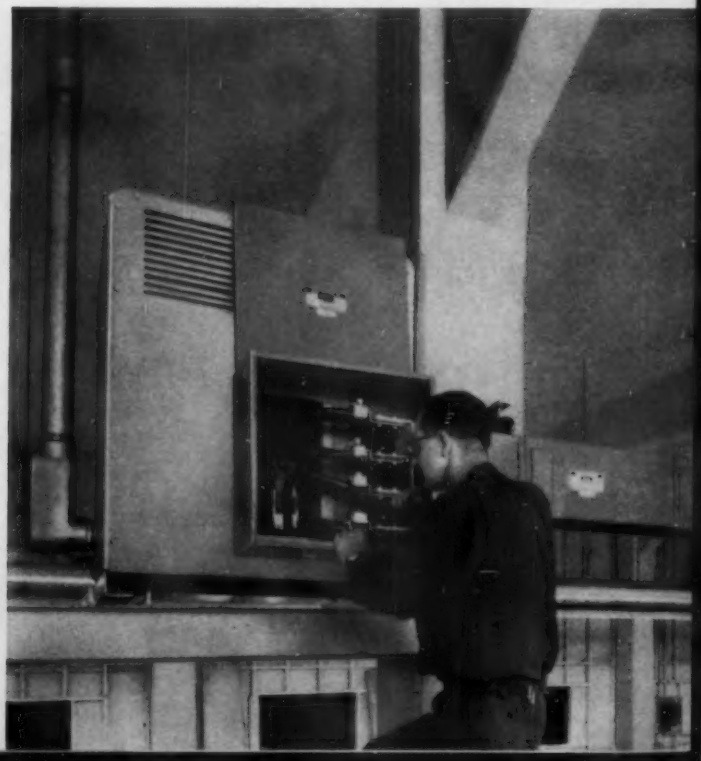
"At $20 a square foot, this saved us $1266 worth of floor space—not including an allowance for service area which would bring the saving to $4000. Since reinforced structural supports were not needed, we saved $40 on support material per unit.

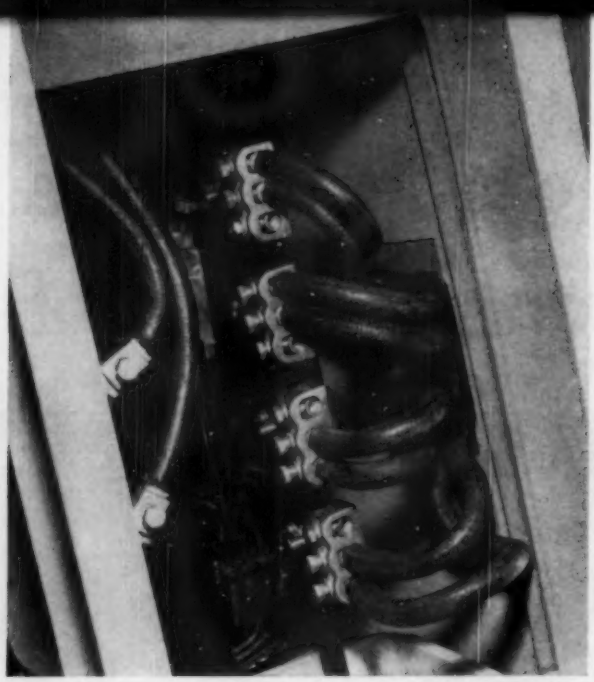
"That's not all. The Westinghouse transformers were quickly positioned with a fork lift truck. Hoisting heavier types would have required rental of extensive rigging equipment, plus 16 man-hours apiece at $68 per day.

"Because of the transformer locations, 15 feet of 7-500,000 circular mill cable were eliminated. At $150 for cable, $50 for conduit and fittings, and $34 for labor, we realized a saving of $234 per transformer, or $2340.

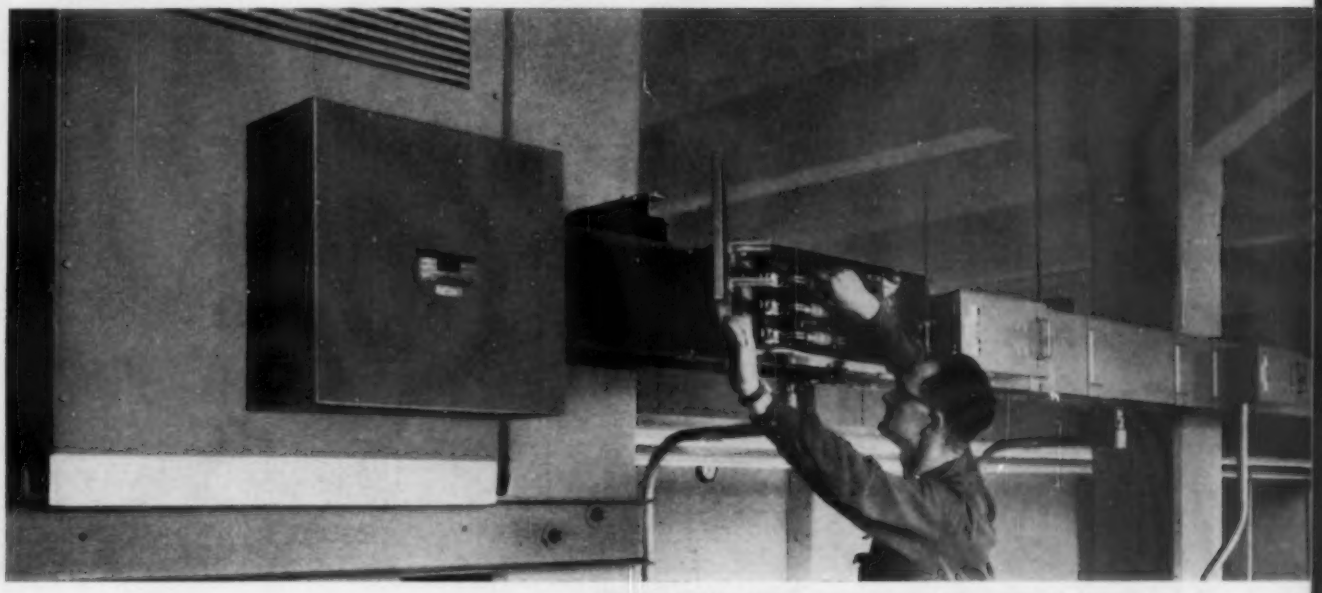
J-70951-2







"In addition, terminal compartments at the transformer bottom meant no extra insulation to withstand heat rise so we achieved a 60% saving. Since the transformers came with built-in shock mounts, we did not have to add them at an estimated total cost of $320.



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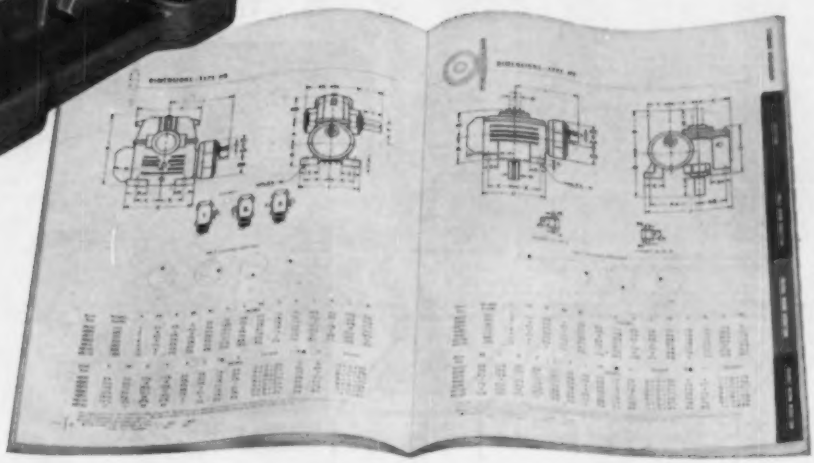

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#1	#2	#3	#4	#10	#40	#41	
4	2	1	2		2		ABOLITE
4	4	2		1			APPLETON
3	4	4					BENJAMIN
3	1						ELECTRO
4			2				MILLER
4			2		2		MULTI
4	4	2					OVERBAGH & AYERS
6	4	4	2	2	2		QUADRANGLE
5	2	2					SMOOT-HOLMAN
4	1		1				SPERO
5		2	2		4	2	STEBER
4	1	1			1		WAKEFIELD
5	4	2		2			WESTINGHOUSE
3	4	1					WHEELER-FULLERTON

*Aluminum Reflectors all others are Porcelain Enamel

Types of RLM-Labeled equipment available from each of the 22 participating manufacturers is shown in the chart.

FLUORESCENT RLM SPECIFICATIONS

UPLIGHT ——→ 0-20% ——→ 10-30% ——→ 20-30%

D-1	D-1	D-1	D-2	D-2	D-2	D-3	D-4	SD-1	SD-1	SD-1	
2-40w	2-40w	2-72w	2-40w	2-40w	2-72w	2-96 H.O.	2-150 H.O.	2-40w	2-72w	2-96 H.O.	
14-18	2-72w 10	2-96 H.O. 12	14-18	2-72w 20	2-96 H.O. 28	2-96 H.O. 24-28	2-150 H.O.	14-18	10	12	
✓	✓	✓	✓	✓	✓				✓	✓	BENJAMIN
✓	✓	✓	✓	✓	✓				✓	✓	✓ CURTIS-ALLBRITE
✓		✓	✓			✓			✓	✓	✓ ELECTRO
✓	✓		✓								ENDER-MONARCH
✓	✓	✓	✓	✓	✓				✓	✓	KEYSTONE
									✓		✓ LIGHTING DYNAMICS
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✓	✓	✓									WAKEFIELD
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✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		WHEELER-FULLERTON
✓	✓	✓	✓	✓	✓						WORK-O-LITE

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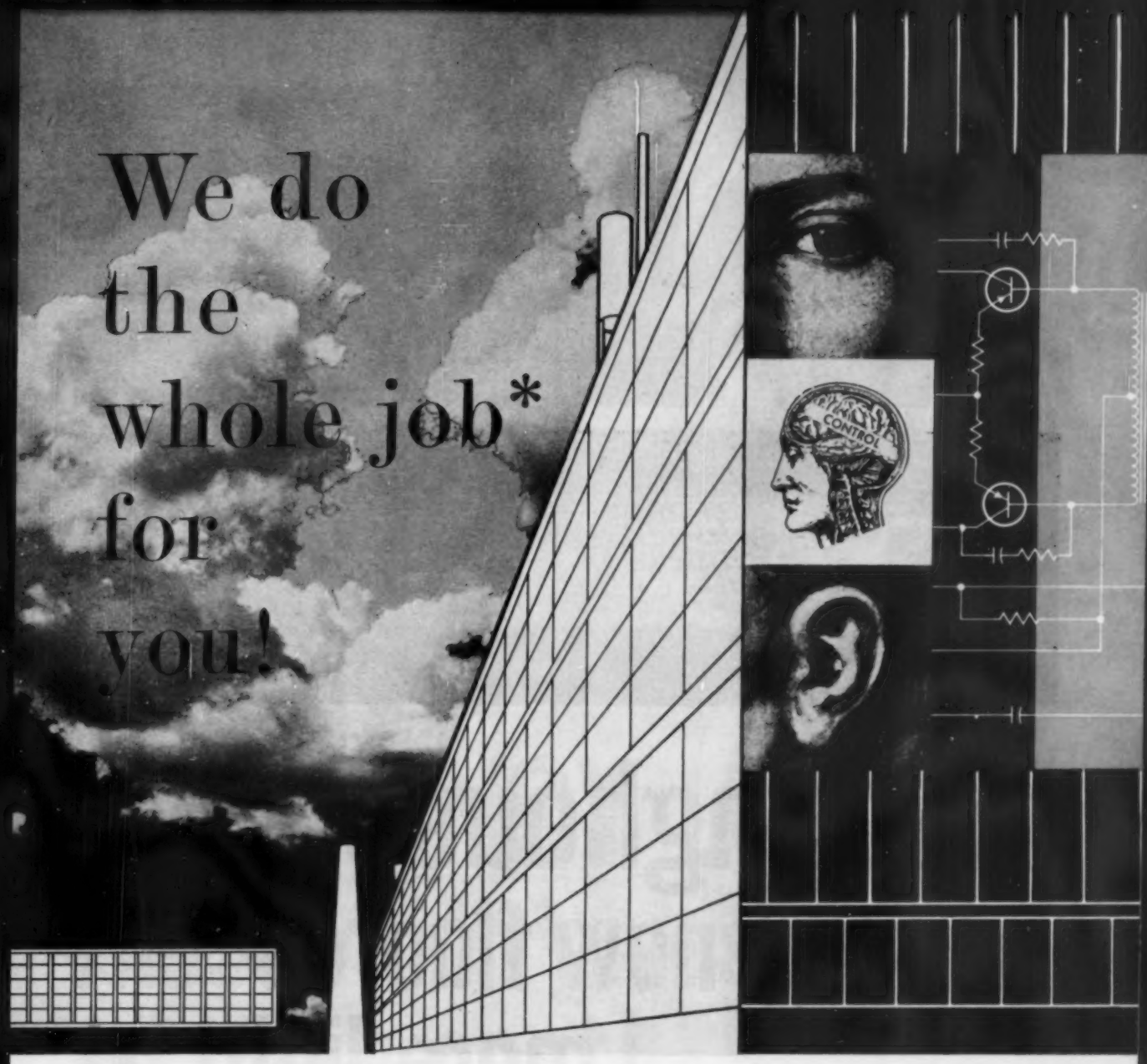

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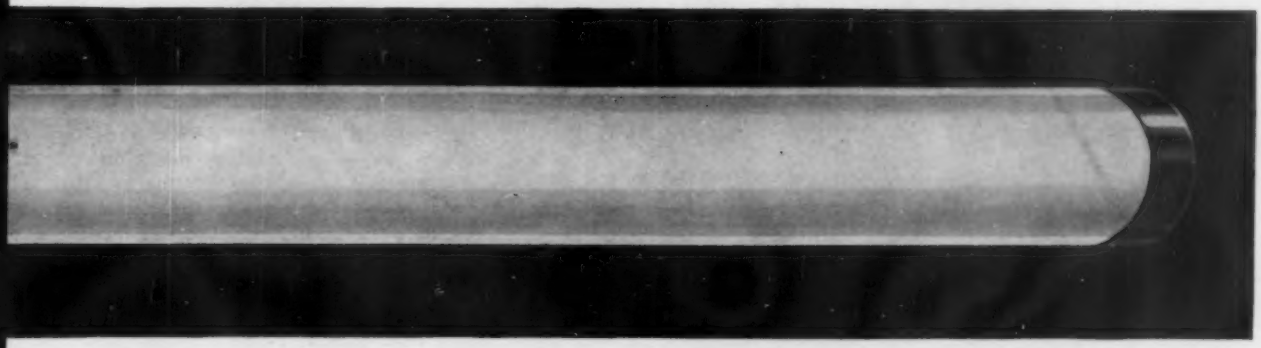

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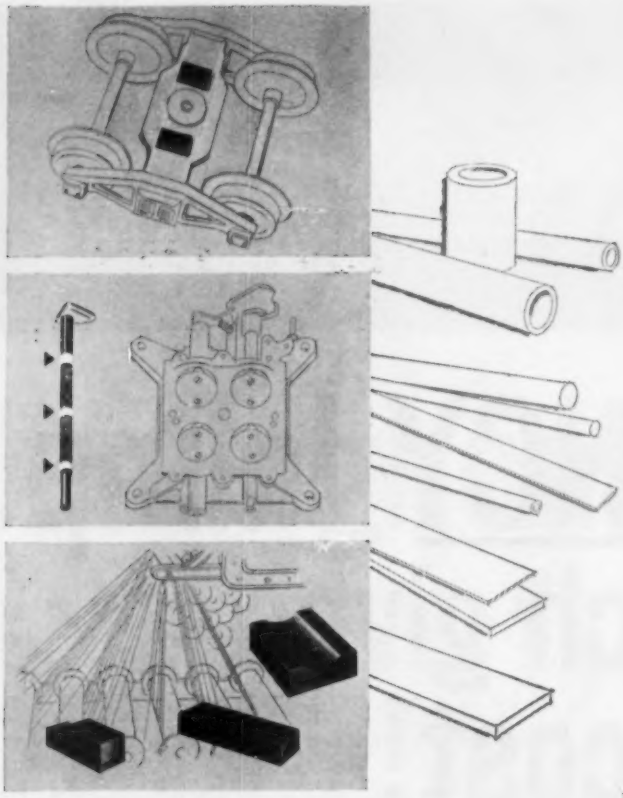

Railroad truck bearings (top), carburetor bearings (center), and saddle bearings for textile machinery (bottom)—fabricated from top-quality Teflon* stock by Garlock—offer performance unmatched by any other material.

Now—new bearings of Teflon eliminate lubrication . . . resist extreme temperatures and reactive chemicals . . . drastically reduce downtime.

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Applied where safety and reliability are essential. Teflon is used as journal and thrust bearings, and on other sliding surfaces where lubricated bearings are undesirable, or incapable of operation in extreme temperatures or corrosive conditions, or where there is a possibility of lubricant failure. Teflon bearings afford unexcelled performance where slip-stick motion must be minimized . . . on reciprocating and oscillating systems where the lowest possible static friction must be attained . . . where space and weight savings are essential.

Easily fabricated from high-quality Garlock stock shapes. Teflon bearings can be simply and economically made from standard Garlock tape, bar and rod stock available through local Garlock distributor outlets. Or, if you wish, Garlock will work to your exact specifications in furnishing bearings of all tolerances and size. Whatever the case, the key to best bearing performance is through the use of Teflon stock shapes by Garlock. With years of experience in research and processing of plastics, Garlock is able to recommend and furnish *exactly* what you need, when you need it, and at the lowest possible cost.

Find out more about Teflon bearings. Consult your local Garlock representative at the nearest of the 26 Garlock sales offices and warehouses throughout the U.S. and Canada.

Or, write for Plastics Catalog AD-177, Garlock Inc., Palmyra, New York.

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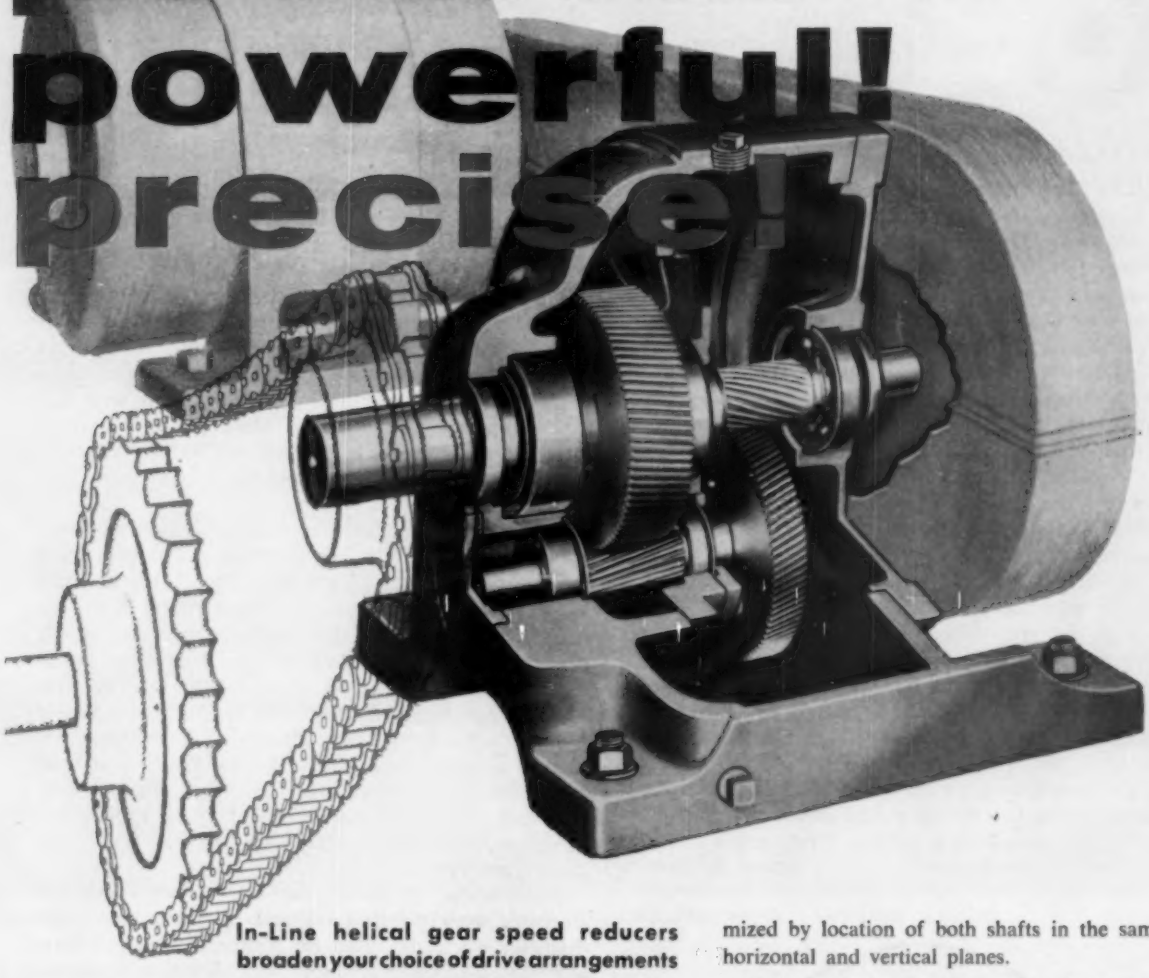

In-Line helical gear speed reducers broaden your choice of drive arrangements

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- ☐ motogears—Catalog 2747
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- ☐ worm gear speed reducers—Catalog 2324-A
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SELECTING A POWER SOURCE FOR ARC WELDING

By J. E. HINKEL, Application Engineer,
The Lincoln Electric Company, Cleveland, Ohio

SELECTING the correct power source for a particular manual shielded metal-arc welding job is an important step towards achieving the lowest possible welding cost. The cost reducing potential in selecting the correct power source goes far beyond reducing the plant electrical bill or lowering maintenance costs.

Unfortunately the facts governing selection are frequently misinterpreted as a result of the emphasis of certain sales features out of proportion to their relative importance in affecting over-all welding costs. This overemphasis is usually due to inadequate knowledge of the factors that affect the cost of welding and their relative importance. These factors should be carefully evaluated and analyzed prior to the selection of a welder.

An analysis of manual arc welding costs reveals that approximately 86 cents of every welding dollar, Fig. 1, is spent for direct labor and overhead. Approximately 12 cents is spent for electrodes. The remaining two cents pay for power and maintenance of the equipment. Obviously, direct labor and overhead have the greatest effect on welding costs. Even though the potential savings in power may be considerable when compared to the equipment cost, the reduction in operator efficiency due to using the wrong power source can result in losses that exceed these savings many times.

Therefore if emphasis is properly placed in selecting the correct power source, the first and most important factor for consideration is the welding procedure. How can the weld be placed at the highest speed in the shortest time?

The correct procedure will be that which deposits the best electrode with the proper welding technique and power source. Contrary to most impressions, there is a correct power source for any given type of electrode. There are very few instances, even with the so-called a-c or d-c electrodes, where a-c or d-c power can be used interchangeably without directly affecting the welding speed, and therefore the welding cost. This is illustrated in Fig. 2.

For example the combination of d-c power and E-6012 electrodes is the best selection for most sheet metal applications. Conversely, for 3/16 in. and heavier plates and structural shapes where fillet, lap and butt welds can be positioned downhand and usually permit "fast-fill" welding techniques, the correct choice would be a-c power and E-6024 iron powder electrodes. This combination results in maximum usable welding current, highest electrode deposition rate, highest electrode mileage, highest arc speed, best bead shape, best weld appearance, and minimum arc blow. Incorrect selection of the power supply on applications of this type can result in losses of $2000 to $3000 per welder per year.

Applications involving the use of low hydrogen electrode usually follow the rule of thumb that small diameter electrodes used on lighter material perform best with d-c equipment, and large diameter electrodes demand alternating current. Vertical and overhead welding where the application requires the "fast-freeze" characteristics of E-6010 electrodes is most satisfactorily handled with a d-c power supply. Welding stain-

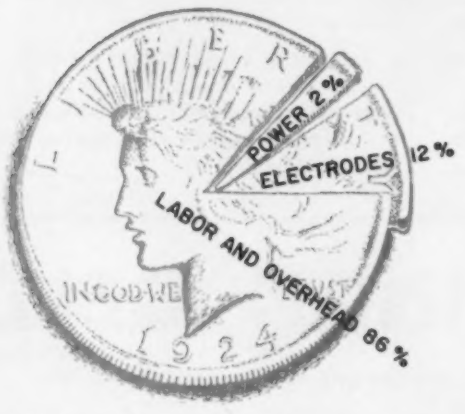
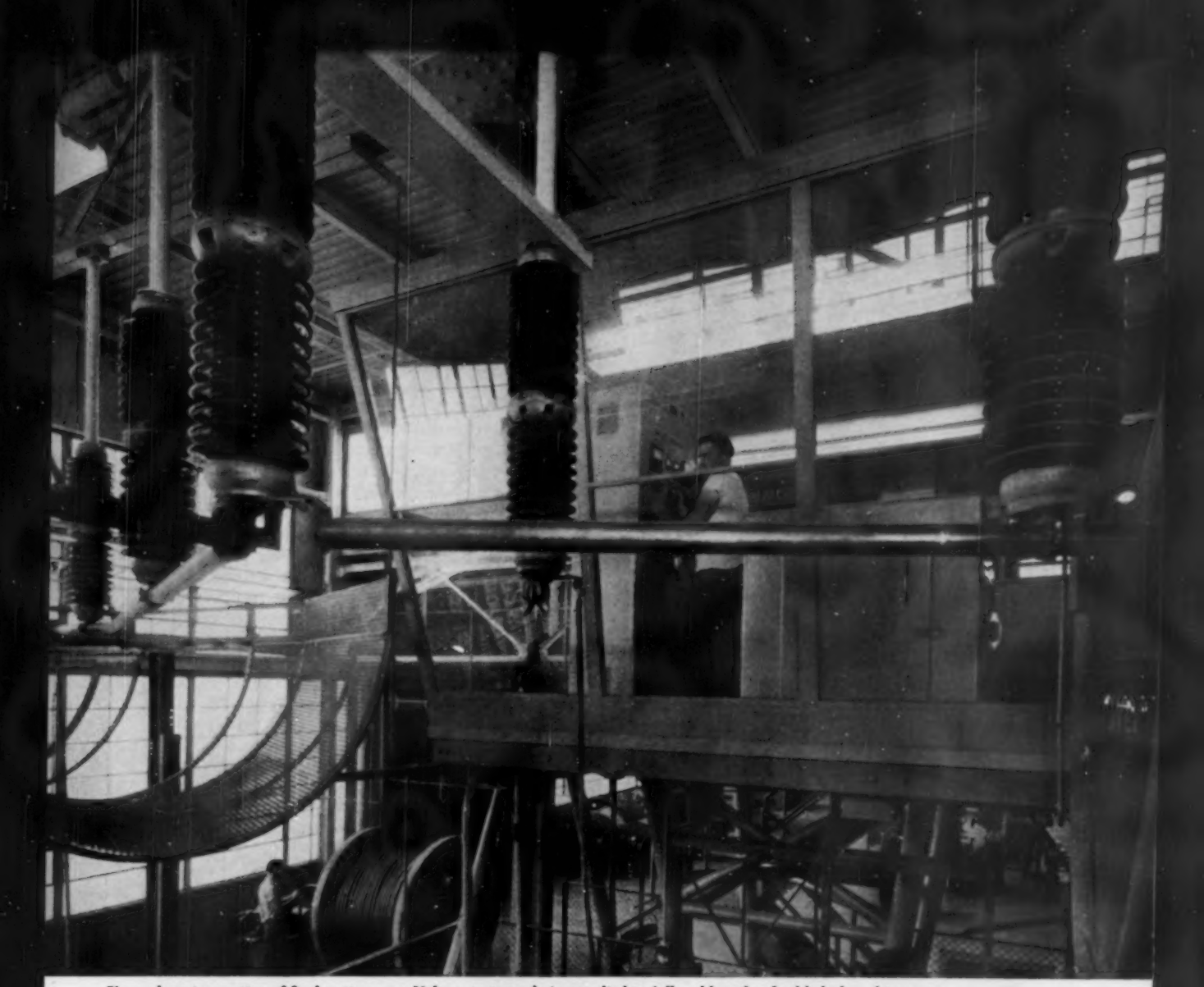


Fig. 1. Analysis of manual arc welding dollar shows labor 86 per cent, electrodes 12 per cent and power 2 per cent.

ELECTRODE SIZE	ELECTRODE TYPE			
	E-6010-11	E-6012-13	E-6014-24-27	E-6016-18
1/8	DC	DC	AC	DC
5/32	DC	DC	AC	DC
3/16	DC	AC	AC	DC
7/32	AC	AC	AC	AC
1/4	AC	AC	AC	AC
5/16	AC	AC	AC	AC

Fig. 2. Best power source deposits the electrode used at the best speed. Here are examples covering a range of sizes.



Shown here is a section of final testing area. Voltage tests are being applied to *full reel lengths* of cable before shipment.

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Quality control at Anaconda is *more* than mere testing and inspection. It is built into every manufacturing step. That's why you can be sure your Anaconda cable will be of high quality—why you can be sure Anaconda Butyl (AB) Cable is the finest rubber-insulated cable you can buy.

Everything you need to know about Anaconda Butyl (AB) high-voltage cable is neatly summed up in a new booklet, DM-5903, "Anaconda High-Voltage Durasheath* Cable." For your copy, write to: Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y. *Reg. U.S. Pat. Off.

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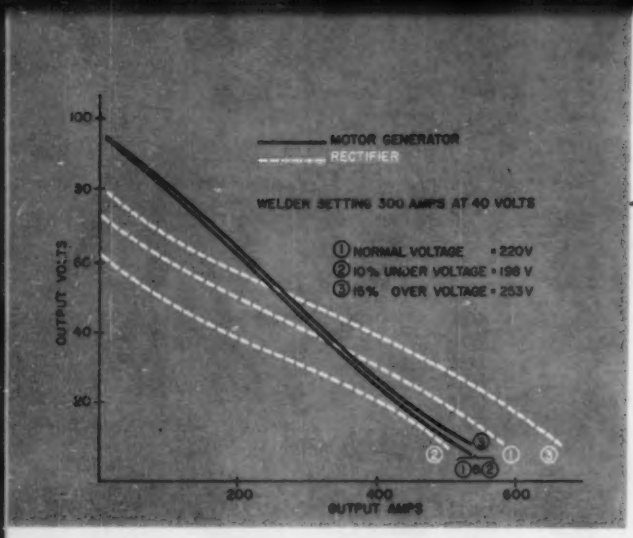
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WELDER SETTING 300 AMPS AT 40 VOLTS
① NORMAL VOLTAGE = 220V
② 10% UNDER VOLTAGE = 198 V
③ 15% OVER VOLTAGE = 253 V
OUTPUT VOLTS
OUTPUT AMPS

Fig. 3. Motor-generator welder is relatively free from power line variations resulting in less interference to welding.

SELECTING POWER SOURCE

less steel and hard surfacing can be most efficiently accomplished with a d-c power supply. To ignore the issue of a-c versus d-c is to cheat the welding procedure of its chance for maximum economy.

A study of the type of welding to be done with the new power source will generally reveal the savings possible through correct application of a-c or d-c equipment. This, in turn, will result in the selection of either an a-c, a d-c, or as applications often justify it, a combination a-c, d-c power supply.

If the decision is in favor of a d-c welder, the choice must be further refined between a motor-generator welder, a rectifier welder or a combination a-c, d-c welder. This decision is somewhat more complicated and involves consideration of all factors, including performance, welding characteristics, maintenance, etc.

The freedom of the motor-generator from power line voltage variations, Fig. 3, combined with a more stable arc characteristic results in less interference with the operator's manipulative technique. Certain types of electrode such as E-6010 and certain welding jobs such as sheet metal and pipe welding are sensitive to line voltage variations. Using the motor-generator on these applications will result in better welds at higher speeds. In addition to its arc stability, the motor-generator has the advantage of dual control to permit varying both voltage and current to suit the job. This control is especially important for out-of-position welding, or any application where the arc is "crowded" into the joint.

Another factor of performance in favor of the motor-generator is that of extra reserve power. A comparison of typical volt ampere curves, Fig. 4, for rectifiers and motor-generators clearly shows an extra usable power range for motor-generator sets not to be found in rectifiers of the same rating. It is true that most welding applications do not require this added performance. However, on some applications such as arc-air-cutting and cutting with special electrodes, superior performance can be gained with a motor-generator. Should a rectifier source be selected for this type of work, it could require the purchase of the next larger size to do the work of a motor-generator.

Consideration of power pertains to both power consumption and the type of power supply available. A-c power sources are the most efficient type available. Rating d-c power sources with respect to the amount of power consumed places combination a-c, d-c welders first, rectifiers second, and motor-generators in third place.

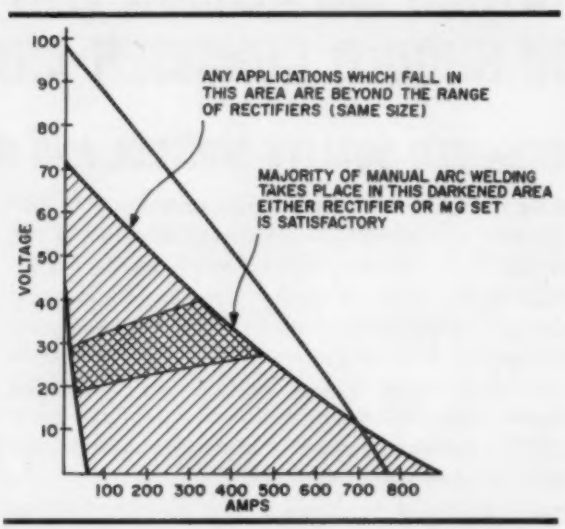
When the type of power supply is limited to single phase, selection is reduced to an a-c or a combination a-c, d-c welder. Motor-generator and rectifier welders are normally only available for three-phase power.

Where three-phase power is available, all power sources can be considered. If the welding procedures demand direct current, selection should include evaluating the relative cost savings from lower power costs and improved procedure efficiency as discussed above. The combination a-c, d-c welders and rectifiers both offer potential reduction in power costs as compared to motor-generators. However, this should be carefully weighed against the cost savings that might result from more efficient welding with motor-generators.

If only a d-c power supply is available, the power source selection will be restricted to a d-c driven motor-generator.

In summary then, the determining factor when selecting a power source for manual shielded metal-arc welding is the efficient use of the welding operator's time. The choice should achieve maximum production performance with the procedure and type of electrode selected. Performance of any particular brand of welder can be best judged from personal experience or the brand's reputation for rugged stamina and dependable operation. Power consumption and maintenance are secondary in importance and should be weighed accordingly. **End**

Fig. 4. Volt-amp curve for 300 amp rectifier, cross hatched, superimposed on volt-amp curve for 300 amp motor-generator.


ANY APPLICATIONS WHICH FALL IN THIS AREA ARE BEYOND THE RANGE OF RECTIFIERS (SAME SIZE)
MAJORITY OF MANUAL ARC WELDING TAKES PLACE IN THIS DARKENED AREA EITHER RECTIFIER OR MG SET IS SATISFACTORY
VOLTAGE
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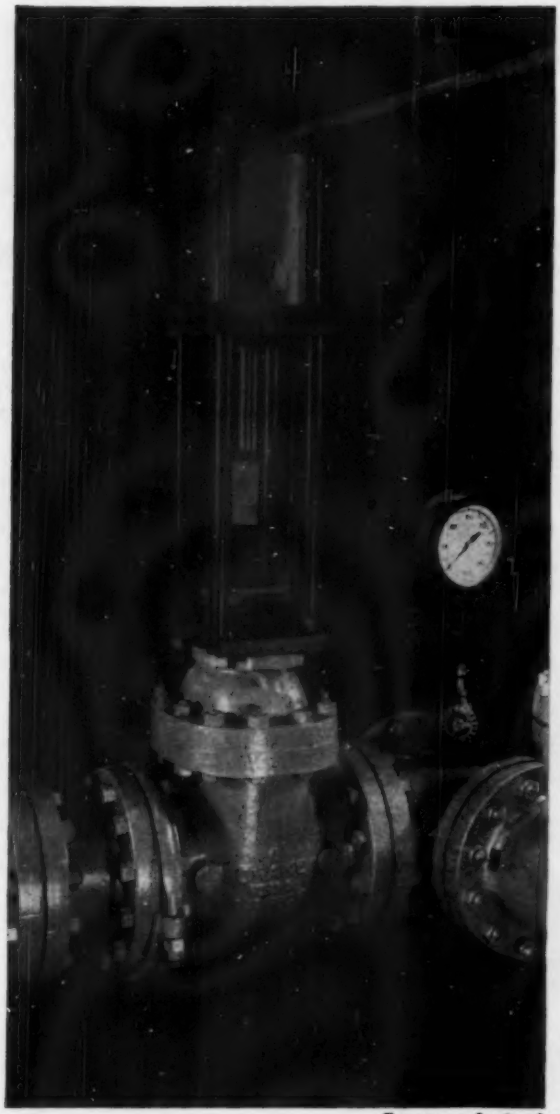

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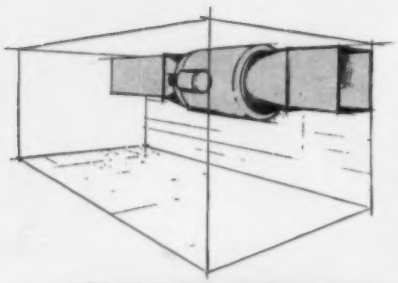
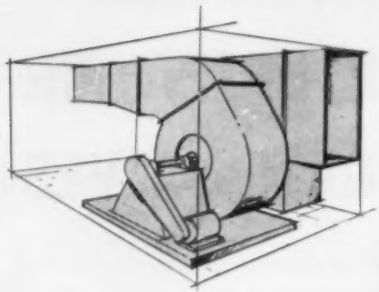




COMPACT FAN CUTS INSTALLATION COSTS

A NEW straight-line-flow centrifugal fan, designed to utilize small areas in both industrial and commercial buildings that formerly were considered to be "waste" space, has just been announced. For specifier and installer, it is pointed out, this will mean cost reduction and simplicity of erection. The compact design makes it possible to hang the fans from the ceiling, mount them on the wall, or stack them one above the other, thus saving valuable floor space.

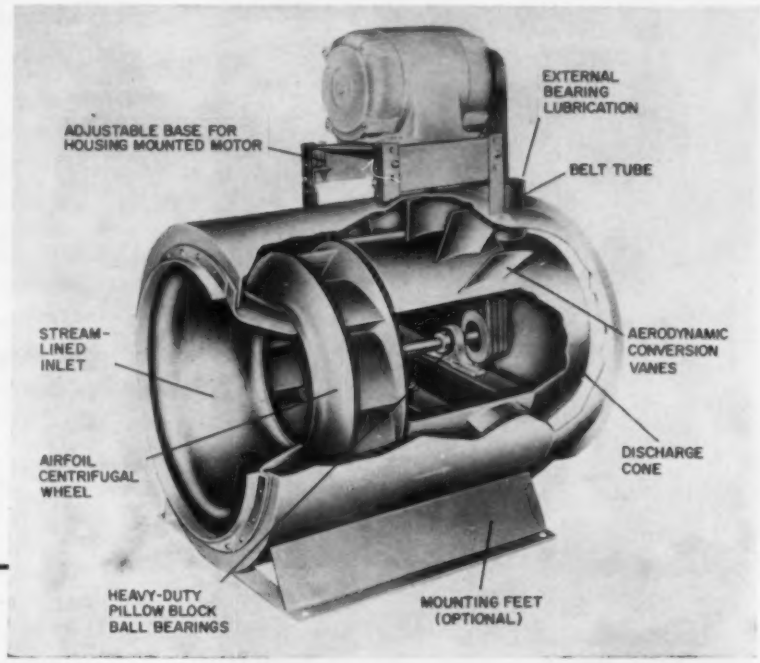
Physical size of the "Centriline" fan, announced by Sturtevant Division, Westinghouse Electric Corp., Hyde Park, Boston 36, Mass., ranges up to 50 per cent less than conventional scroll-type units. This has been achieved by shaping the housing to provide "straight-through" air flow rather than right-angle flow.

While the exterior shape of the fan resembles that of an axial fan, it is definitely of the centrifugal type. High efficiency is said to be achieved primarily through design of the centrifugal wheel which enables the air to follow the blade contours closely and prevent noise-producing turbulence on the upper blade surfaces. Newly-developed aerodynamic conversion vanes also play an important part in the minimizing of noise.

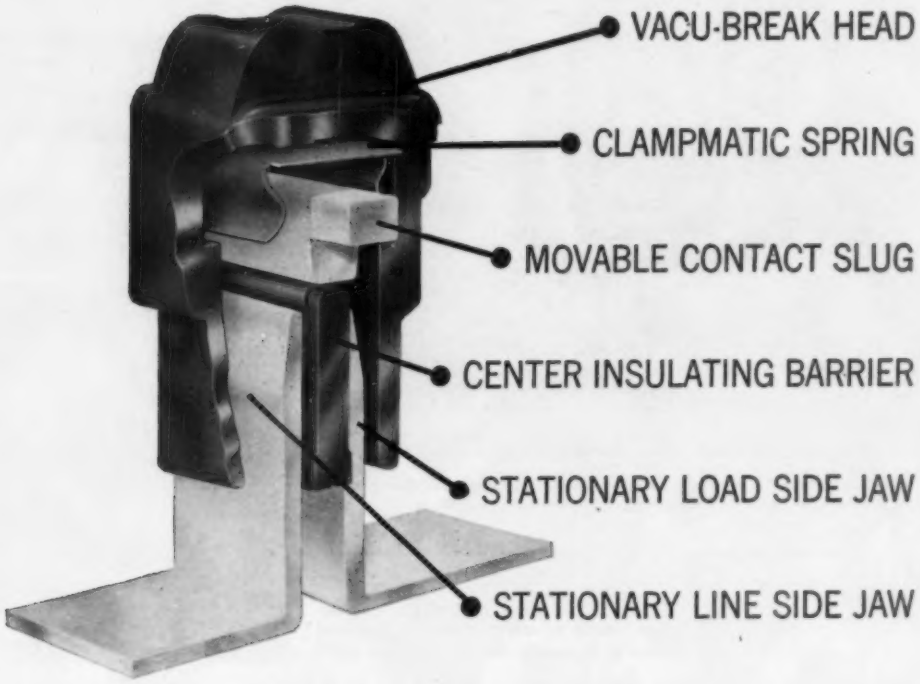
The new fan is rated according to the same Air Moving and Conditioning Association (AMCA) classifications as conventional scroll-shaped centrifugal fans. It is available in six sizes, with airfoil wheels from 27 in. to 44½ in. in diameter, all of unobstructed design. The heavy steel all-welded casing is rigidly braced internally to carry the weight of the largest motors and allows for two methods of mounting: (1) with motor base right on the fan housing, and (2) with motor mounted separately on an integral vibration base. Both arrangements are V-belt driven. Volumes range from 4700 cfm to 46800 cfm; pressures up to 9 in. of water static.

Installation is simple because inlet and outlet dimensions are the same, and one size duct may be used. Performance and sound levels closely duplicate those of the conventional scroll-shaped airfoil-bladed centrifugal fans of the same wheel diameter.

In effect, the new fan makes it a relatively easy matter for more supply and exhaust systems to be installed in the same space, thereby reducing the number of equipment rooms required. In turn, because of the important savings in space, equipment rooms can be smaller with a consequent saving in construction investment. The space saved can also be evaluated in terms of greater utilization. **End**



Cutaway illustration shows unique construction of the new centrifugal fan.



INCREASED SWITCH LIFE WITH CLAMPED PRESSURE CONTACT AND VACU-BREAK ARC CONTROL

You get longer switch life from BullDog safety switches, thanks to unique BullDog design. The high-tension Clampmatic® spring puts pressure where it belongs—on contact faces after the switch is "ON." This clamped pressure action assures good electrical contact for the life of the switch. It means the switch lasts longer, too, for there's no overheating to damage switch components. In switching "OFF," the pressure's removed before the "break" . . . providing true quick-break action.

Vacu-Break® design is another reason BullDog safety switches last longer. Switching contacts are completely enclosed in the Vacu-Break head. Arcs are restricted, starved of oxygen, cooled and smothered quickly. In addition, Vacu-Break *double*-breaks the circuit, effectively reducing the arc length and arcing time.

Vacu-Break arc control plus clamped pressure contacts add up to long switch life . . . and dependable, economical service for you. You'll find BullDog safety switches need little or no maintenance over years of heavy-duty use. See your BullDog products distributor.

FOR SAFETY'S SAKE—BUY VACU-BREAK!

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N.Y.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

For more facts circle 594 on Reply Card

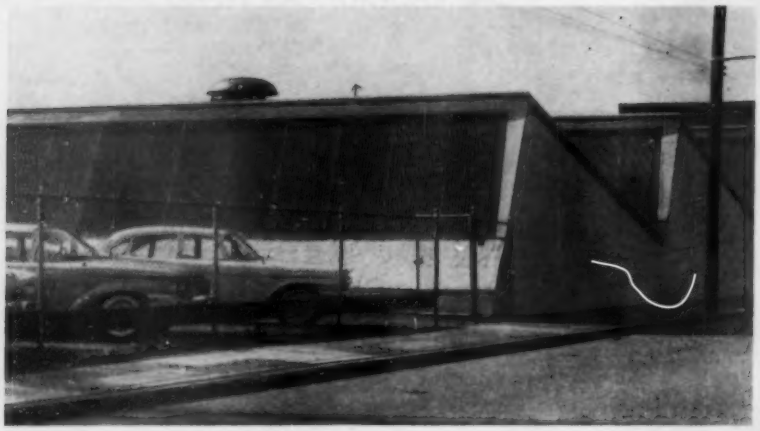


Fig. 1. Typical of modernization program is this installation of plastic glazing in one of company's 23 multi-level buildings. Soft green tint plastic was chosen.

Fig. 2. Light coming through translucent plastic panels means that artificial lighting is rarely needed on day shift.

PLASTIC GLAZING SAVES $43,000 IN MODERNIZED PLANT

HOW CAREFULLY planned modernization of plant facilities pays off in improved production, greater safety and maintenance savings, is told by H. L. Becker, plant engineer of the Dana Corporation's Pottstown, Pa., Division.

Thanks to a painstaking analysis of the problem, strategic scheduling of the four-year, $5,000,000 modernization program, and close comparison of the cost of available ways of bringing up-to-date the 23, multi-level structures that comprise the plant, Dana accomplished these objectives without interrupting production and with substantial savings.

Dana officials had known for a long time that modernization was in order, but the demand for the company's products made it difficult to interrupt production. Nevertheless, the Dana plant engineer and his staff worked out the modernization schedule in such a way that the program was carried out over a period of four years, with no interruption to production.

Typical of the planning was the approach to the problem of skylights, windows and ventilation. The choice lay between replacing the loose, warped, rusted steel sash and defective panes—maintenance of which ran $12,000 yearly—with conventionally glazed new metal operating sash, or installing continuous runs of glass fiber reinforced panels, and a forced air circulation system.

Close comparison of costs showed that the use of Structoglas glass fiber reinforced plastic panels instead of new glass and operating sash could save $100,000. Even with the additional cost of the forced air ventilating system, the savings amounted to $43,000.

Shadowless Light

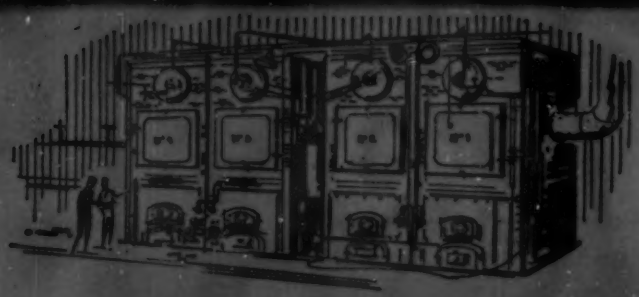
The panels specified were structural grade, 2-oz glass fiber reinforced material 1/16-in. thick, in "softlight green" tint that provides ample light passage while filtering out unwanted infrared and ultraviolet rays. It also gives shadowless lighting. Panels were bolted in place with minimum framing.

The choice of color was based on SPI light transmissometer test data showing that the tinted panels pass 69 per cent of available daylight while reducing infrared transmission to 43 per cent and ultraviolet to a scant 2 per cent.

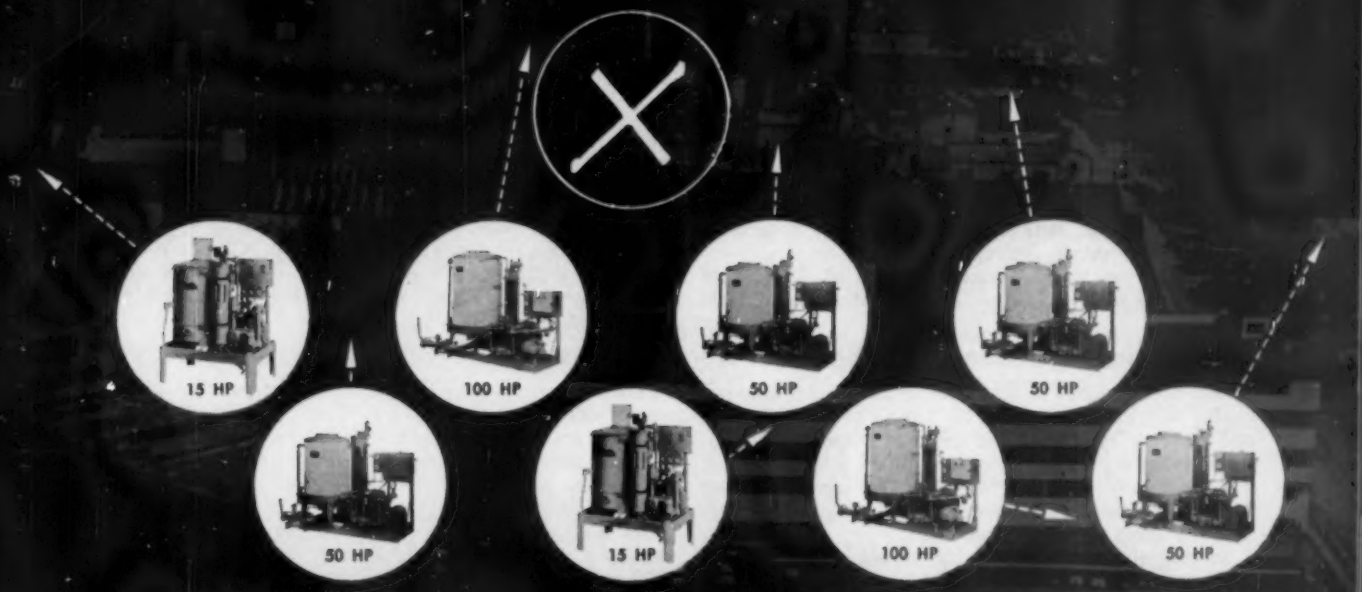
Although it is too soon to draw any conclusions about the probable life of the 32,000 sq ft installation of Structoglas, it appears to be in like-new condition after a year of service, and has yet to present the first maintenance problem or expense.

The forced-flow ventilating system has also proved superior to the old operating window and roof-top method. The new system has fully controlled air flow, so that air no longer moves from inherently dirty areas into cleaner departments. Air is changed every three minutes, throughout the plant.

Other extensive improvements have resulted in similarly marked advantages. The new common-level floor, formerly concrete, is now surfaced with 2½-in. end-grain wood blocks, which provide an excellent base for machines and better footing for the operators. **End**



Central Boiler Room ..... as obsolete as the line shaft



W. P. FULLER & CO. SAVES BIG MONEY WITH CLAYTON'S MODERN Decentralized Steam

Here's how: 8 compact Clayton Steam Generators were installed, each close to a point of use. Total cost—*less* than the cost of replacing just the old steam mains. And by eliminating these inefficient lines, ⅓ of the total HP requirement was saved. Entire central boiler room space was freed for plant expansion. The old 75-foot stack was retired. Fuel savings were 50%. Personnel costs were reduced.

These savings were proven at W. P. Fuller & Co., South San Francisco. All depend on the extreme compactness, fast steaming and operational economy of the Clayton. In your own plant, large or small, decentralized steam savings like this are entirely practical. Write for full information.

420

Clayton MANUFACTURING COMPANY

463 No. Temple City Blvd., El Monte, California

For more facts circle 595 on Reply Card

Reactor Goes Critical; Will Soon Produce Power for New England Utilities

THE NUCLEAR REACTOR for the nation's latest atomic power plant has gone critical at the Yankee Atomic Electric Company's plant in Rowe, Mass. Latest advance in the development of water-cooled and moderated nuclear reactors, the reactor in the 136-megowatt electric generating station is the largest yet designed and developed by Westinghouse Electric Corporation.

The plant was put into its criticality phase following two weeks of work getting 76 uranium oxide fuel assemblies placed into position to make up the core, or fuel charge, of the reactor.

Fissioning atoms in the reactor will heat high pressure water in the primary system to 529 F. The water in the system will be under a pressure of 2000 psi and will flow through the pressure vessel at a rate of 94,800 gpm. Travelling through a heat exchanger, it will heat water in a separate secondary system, turning it into steam. From this point, the generating station operation is the same as at a conventional station—the steam drives a turbine-generator to produce electric power.

Fuel for the Yankee reactor consists of 25 tons of slightly enriched uranium oxide pellets. More than 23,000

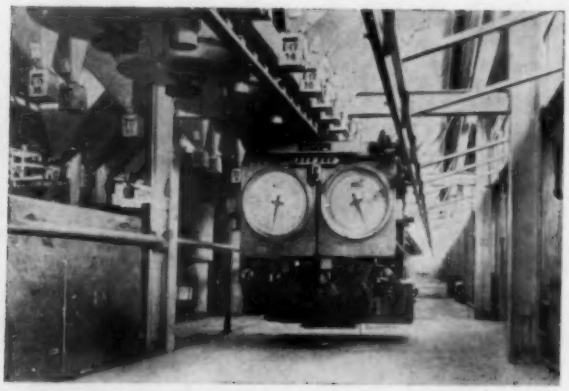
stainless steel tubes, filled with these pellets, have been fabricated into the 76 fuel assemblies, each of which is approximately eight feet long and eight inches square. The oxide pellets themselves are 0.294 in. in diameter and 0.6 in. long. There are almost 3,500,000 in the reactor.

Automatic, Card-Controlled Batch Weighing Improves Grinding Wheel "Mix"

ONE OF THE MOST critical areas in maintaining uniform quality in grinding wheels is the mixing of abrasive grain and bonding materials. The ratio of abrasive to bond determines the grade or "hardness" of the grinding action. Therefore, any errors in weighing the ingredients into the batches used in molding the grinding wheels can seriously affect the finished product.

In designing its new organic bonded grinding wheel plant, Norton Company included completely automatic weighing equipment in the design.

The system consists of three weighing carriages suspending on a monorail mounted beneath the row of tanks containing the various sizes and types of abrasive grain and bonding materials. The carriages travel in a loop in one direction only. To operate the system, the mixing foreman places a stack of punched cards in a pedestal mounted dispenser at the beginning of the cycle. As the carriage is brought into position, the dispenser issues one card to it representing one batch of mix. The card then takes over the control of the carriage which acts as a robot throughout the cycle, drawing the correct amounts from the proper tanks and finally discharging the hoppers at the correct mixing stations.



The starting point of the process is the punched card, which tells the control equipment on the carriage: The abrasive grain tank from which to draw; the tank of bonding material from which to draw; the weights required for both grain and bond; the mixing station designated to receive the batch.

As the carriage moves along the monorail, proximity heads on the carriage superstructure count off the tank markers and slow the carriage in time to stop at the correct tank. A mechanism on the carriage engages the gate and opens it, allowing the ingredients to fall into the hopper. As the correct weight is approached, the gate is throttled and the last few ounces are fed in slowly to insure accurate weight.

When the total weight of abrasive grain and bond has been drawn into the hopper, the carriage moves around the loop to the discharging area. An elevator lifts a section of monorail to the high level and the carriage travels along to the designated mixing station. The short section of monorail in the carriage (at right angles to the direction of travel) which holds the batch hopper tilts and the individual hopper rolls out of the carriage onto a spur track over the mixing station. Then the carriage advances a few feet to another spur rail where an empty hopper is waiting for the next cycle. This also rolls by gravity into the carriage.

If an empty hopper is not ready at this station, the mixer operator pushes a reset button which advances the carriage to the next pickup station. If he fails to punch the reset button, a warning siren sounds.

The carriage continues to a second elevator which lowers the carriage to the lower level, whereupon it continues around the loop to the starting point.

Because three carriages operate on the same monorail, provision had to be made to prevent collisions. Lights mounted at each end of each carriage are part of an electric-eye control system which keeps the carriages at a safe distance from each other.

This system was tailor-made for this plant by the Heltzel Steel Iron and Form Company of Warren, Ohio.

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For more facts circle 595 on Reply Card

Some basic steps to SILENT VENTILATION

The Most Important Step you can take when it comes to deciding *which* power roof ventilator is right for you is to look at an Ilg LSQ. If *capacity* is a prime factor, step up and see Ilg's 11 sizes: from 87 c.f.m. all the way up to 21,000.

If it's *silent operation*, then check these features: direct-connected fan and motor eliminate belts and pulleys; patented Type "Q" wheel is dynamically balanced before being connected to permanent-split capacitor 1-phase or 3-phase motors; totally enclosed constant- and 2-speed motors assure smooth power flow.

For a *first* step toward better ventilation, write for Bulletin No. 2302.

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2832 N. Pulaski Road,
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Offices in
60 Principal Cities

Member of Air Moving and Conditioning Association, Inc. (AMCA)

Polar-Type Cranes Get Similar Assignments in Reactor Shells

THE SECOND of two Polar-type cranes installed in New England has been erected at the Watertown Arsenal Nuclear Facility in Watertown, Mass. The first crane is in service at the Massachusetts Institute of Technology.

The Polar-type crane operates at high efficiency on the rim of circular tanks and similar shell structures. It runs on a single runway rail which is completely circular in form. Because of this, the crane end trucks always move in opposite directions. The usual center drive, with squaring shaft and direct-driven or gear-driven truck wheels, is not applicable to this type of installation. Therefore, in both the installations, individual drive motors were placed at each truck, and each motor equipped with an electric brake and enclosed gearing.

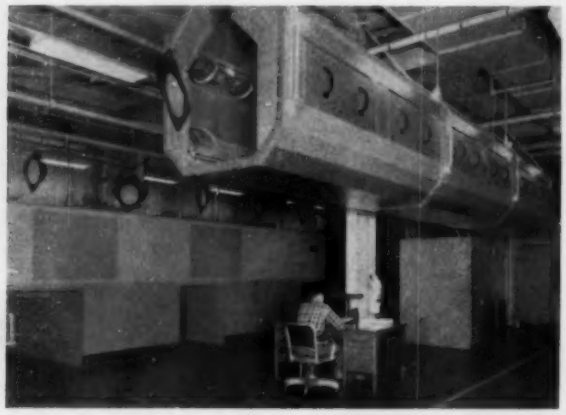
A unique control system balances the two motors and prevents one from forging ahead of the other. Should one motor get ahead of the other, a jam-up results, because the crane is no longer working on the diameter of the rail, but on a chord which is shorter than the diameter.

Both cranes were built by the Shepard-Niles Crane & Hoist Corporation, and were installed by Robert Abel & Co. Hoisting bridge and trolley speeds are identical;

speed of main hoist, 12 fpm; auxiliary hoist, 30 fpm; bridge, 60 fpm; trolley, 40 fpm. The ten-ton crane at Watertown operates on a 77 ft, 4½ in. span, with a maximum lift of 71 ft; the twenty-ton crane unit at M. I. T. spans 72 ft, and has a maximum lift of 44 ft., 6 in.

Five-Stage Cleaner, Overhead Ovens Combine To Finish Instrument Parts

CLASSIFIED AS ONE of the cleanest, most modern to be found in industry today, the finishing department of the Foxboro Co., Foxboro, Mass., was designed with dual objectives. First, a quality finish for their product, and second, working conditions as near ideal as possible.



To provide a high degree of automation to the process, a five-stage metal cleaning machine, designed and built by R. C. Mahon Co., was installed. Controlled by Foxboro instruments, it permits two lines of work to be treated at the same time. On twin conveyors, the work travels through the 62-ft long machine at the rate of eight feet per minute.

In sequence, the work is subjected to a 45-second alkali spray cleaning at 165 F; a 30-second hot water rinse; a 90-second treating spray at 110 F to etch and treat the metal; a 30-second cold water rinse; and final chromic adic acid rinse at 110 F to neutralize any excess treating solution remaining on the parts.

The work then enters an overhead drying oven—one of four specially designed to keep floor space clear. The oven operates at a temperature of 350 F to completely dry the parts. The other ovens are used for force-drying of the primer and first coat of lacquer, and for final bake of the finish coat.

Aluminum Tubing and Sheet Fabricated into Outsize Electrical Bus

A GROUP OF LARGE-DIAMETER aluminum tubes have been fabricated by Delta Star Electric Div., H. K. Porter Co., into what are believed to be the world's largest buses.

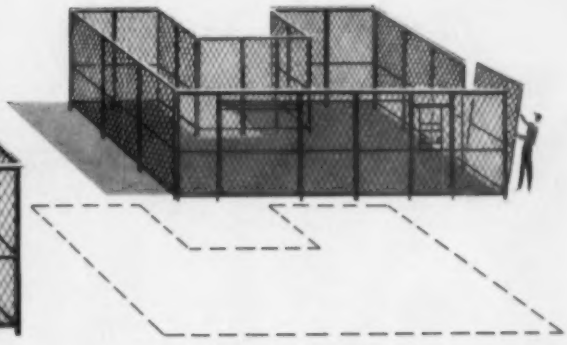
For use as generator leads or station bus (to carry electrical energy from a turbine generator into the switchyard of a power plant) the buses are 19 and 20.5 in. in diameter, with ⅝-in.-thick walls. They are rated at 10,000 to 11,500 amperes, for operation at 12.6 to 16.5 kv.

The 19-in.-diameter tube is an extrusion, supplied by Aluminum Company of America. The 20.5-in.-diameter tube is roll- or brake-formed from Alcoa aluminum plate.

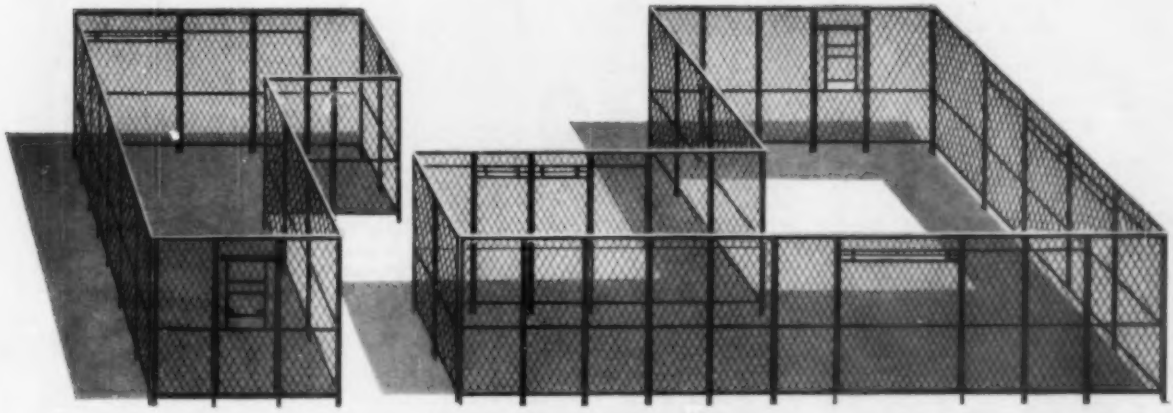
The bus is of telescoping design, with flexible leads for the bus joints permitting movement at the point of joining. These leads are flexed laminations of 40 aluminum sheets welded to aluminum plate at either end.

EXPANDED METAL PARTITIONS BY WHEELING

Here's the partition system...



you can move...



or rearrange...

or enlarge!

Want effective partitions that will help keep your plant layout flexible? Then look what Wheeling Expanded Metal Partitions offer!

STANDARDIZED PARTS let you move doors and panels quickly and easily...even change entire layouts without buying new components.

FAST DELIVERY because Wheeling makes and stocks America's most complete standardized expanded metal partition systems.

THEFT PROTECTION because expanded metal is solid steel . . . can't be unraveled like wire mesh.

INCREASED SAFETY because expanded metal permits free passage of heat, air, light, fluids and sound.

Get the complete details on Wheeling Expanded Metal Partition Systems from your Wheeling man. Wheeling Corrugating Company, Wheeling, West Virginia.

WHEELING CORRUGATING COMPANY • IT'S WHEELING STEEL!

Immediate delivery on all stocked items from these warehouses: *Boston, Buffalo, Chicago, Columbus, Detroit, Kansas City, Louisville, Minneapolis, New Orleans, New York, Philadelphia, Richmond, St. Louis.* Sales Offices: *Atlanta, Houston.*

For more facts circle 597 on Reply Card

NEW PLANT CONSTRUCTION —advance information on location, costs

Anchorage, Alaska—Permanente Cement Co., an affiliate of Kaiser Industries Corp., Oakland, Calif., will begin construction at once on a new cement manufacturing plant at Sutton, Alaska, near Anchorage. A 25-acre site has been acquired for the new plant. Initial capacity of the facility will be about 500,000 bbl of cement annually. The plant and land acquired will cost approximately $5 million. Plant will go into operation early in 1962.

San Diego, Calif.—Convair Division of General Dynamics Corp. has construction under way on a large manufacturing facility in which it plans to produce intricate parts for advanced weapons systems and space vehicles. New structure with a floor area of 68,000 sq ft will have no windows and is expected to be completed by the end of the year. Cost of the new facility is reported to be in excess of $1 million.

Pueblo, Colo.—Linde Company, Division of Union Carbide Corp., 30 E. 42nd St., New York, N. Y., has construction under way on a $2-million oxygen-producing plant adjacent to Colorado Fuel & Iron Corporation's steel-making facility here in Pueblo. The new plant will produce 200 million cu ft of oxygen monthly. The oxygen will be supplied to Colorado Fuel's new oxygen converter units that will speed up the steel-making process to 30 to 60 minutes compared with the present 7 to 10 hours.

Seaford, Del.—E. I. du Pont de Nemours Co., Du Pont Building, Wilmington, Del., has authorized a $9-million modernization and expansion program at company's nylon plant located here. Project, to be completed in about one year, will increase company output by a substantial margin. Expansion is directed primarily at stepping up production of carpet nylon.

Brewster, Fla.—American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y., will begin work at once on the construction of a new plant for the production of phosphoric acid for fertilizers. Plant will be built adjacent to existing facilities and when completed late in 1961 will bring the Brewster unit's production capacity to 400,000 tons per year. Cost of site and plant is believed to be in excess of $6 million.

Palm Beach, Fla.—Radio Corp. of America, 30 Rockefeller Plaza, New York, N. Y., has broken ground here for the construction of a large manufacturing plant for the production of RCA's Series 301 electronic computer system. Work on the plant is scheduled for completion in the spring of 1961. New facility will supplement office, engineering and manufacturing operations at RCA's computer headquarters in Camden, N. J. Cost of the new plant reported to be about $4 million with equipment.

Pensacola, Fla.—Armstrong Cork Company, 1010 Concord St., Lancaster, Pa., plans major addition to company's plant located here. Plans call for a 75,000-sq ft addition to company's 225,000-sq ft existing plant, manufacturing acoustical and fiberboard materials. This is the latest step in an expansion program started earlier this year.

Chicago, Ill.—North American Car Corp., 231 S. La Salle St., has announced plans for a major expansion and improvement program of company's facilities here. Company has authorized the expenditure of $1 million on the expansion of its Sag Junction Terminal. Included in the project, which is already under way, are the erection of 10 new 630,000-gallon storage tanks, construction of a new 600-ft concrete dock and other improvements. Work is scheduled to be completed by the fourth quarter of 1961.

Mundelein, Ill.—Ball Brothers Company, Ryan and Burt Streets, Muncie, Ind., plans to construct a glass container manufacturing plant on large site here. Plant will produce glass containers for the food, beverage, chemical and pharmaceutical industries. Construction will get under way at once and plant is slated to start operations in the spring of 1961. Cost of the new plant with equipment will amount to several millions of dollars.

Rochelle, Ill.—Swift & Co., 4200 Packers Ave., Chicago, Ill., will begin construction on a new meat packing plant here, at a cost estimated in excess of $5 million. New plant will process cattle and hogs and prepare smoked meats such as hams, bacon and a wide variety of sausages. Construction contract has been let to J. L. Simmons & Co., Chicago, Ill. In addition to the main building at Rochelle, facilities will include a pen and holding yard for storage of cattle and livestock.

Fort Madison, Iowa—California Spray-Chemical Corp., wholly owned subsidiary of Standard Oil of California, plans to construct a large fertilizer plant on tract recently purchased by the company. New facility will produce more than 1000 tons per day of complex pelleted fertilizer, ammonium nitrate and anhydrous ammonia for agricultural and garden use.

Ashland, Ky.—Armco Steel Corp., 1939 Armco Ave., Middletown, O., plans to expand the storage areas and handling facilities at its works here. A storage yard will be expanded to accommodate 1,050,000 tons of ore and pellets. Construction of a second and large ore bridge will get under way at once and will be completed by the spring of 1961. Cost of the new expansion program and increased facilities will be about $3.5 million. In addition, about $500,000 will be spent in moving a creek that runs through the property to provide more storage space for scrap and ingots.

Boston, Mass.—Gillette Safety Razor Co., a division of the Gillette Co., 15 Gillette Park, this city, plans a multimillion dollar plant expansion and development program. Three buildings will be constructed on property recently purchased from the American Sugar Refining Co., covering about 230,000 sq ft of space. Work on the new project will begin early in 1961 after present structures are removed from the site. Largest of the three buildings, which will be more than 1000 ft in length, will house the blade manufacturing division. A second building will provide receiving and shipping facilities and the third building will provide administrative and reception facilities.

Detroit, Mich.—Ford Motor Co., 3000 Schafer Road, Dearborn, Mich., plans to construct a high capacity oxygen plant here for company's steel operation. Work on the plant which will have a daily capacity of 280 tons of gaseous oxygen, 10 tons of liquid oxygen and 1.4 tons of liquid nitrogen will get under way soon for completion by December of 1961.

Inkster, Mich.—Calumet & Hecla, Inc., 11 Calumet Ave., Calumet, Mich., plans to install a $1.6-million facility at plant located here, for the fabrication of special metals. New production equipment will be housed in a 60,000-sq ft plant formerly occupied by Flexonics Corp., a subsidiary. Initially, production will be confined to zirconium and titanium tubes and rods, with production of other metals, including tantalum, columbium, vanadium, molybdenum and chromium to be undertaken at a later date.

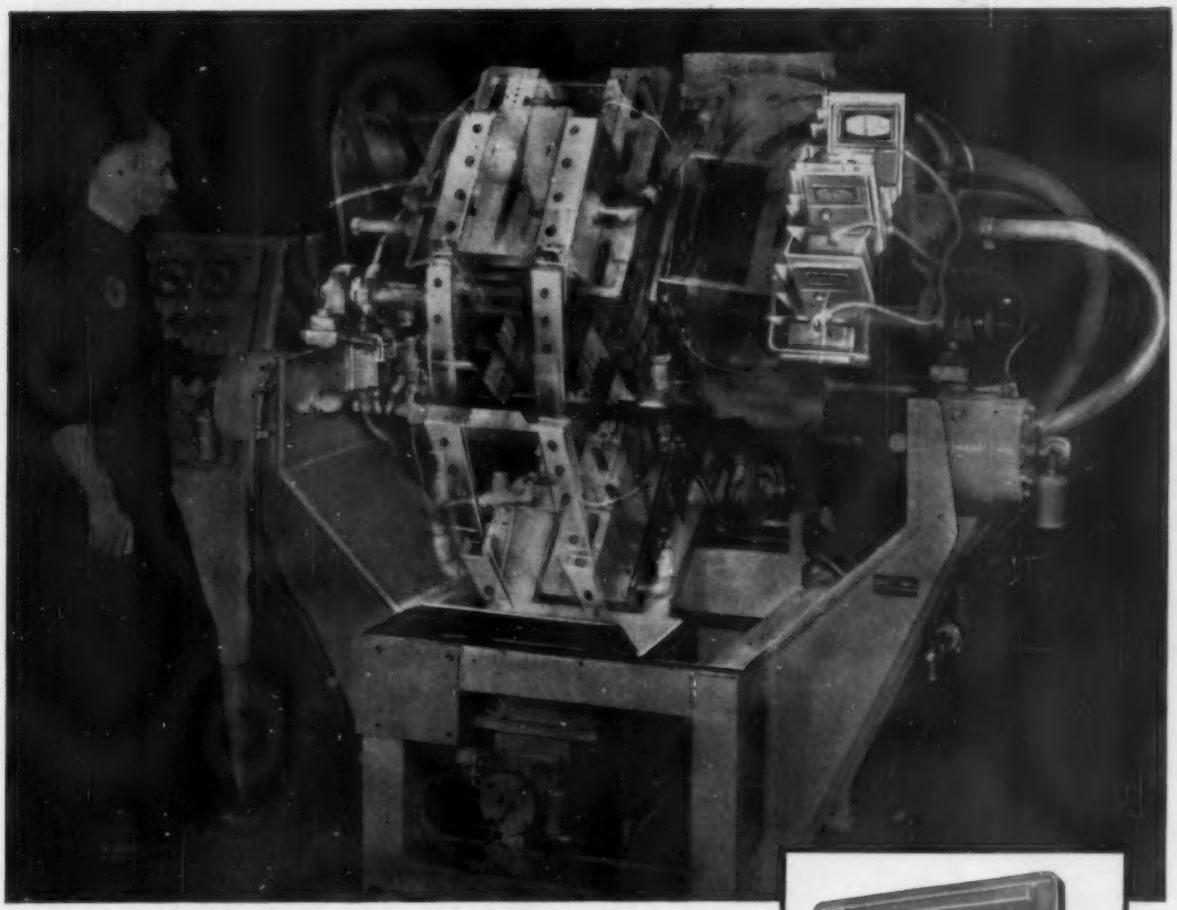
Wyandotte, Mich.—Wyandotte Chemicals Corp., Alkali Square, plans to expand its production of high quality lime by converting coke-fired kilns to gas firing. The first units will begin production by the early part of next year, with an annual capacity of 1,500,000 tons planned.

Edison, N. J.—National Can Corporation, 3219 W. 47th Place, Chicago, Ill., plans to erect a can manufacturing plant here. Work on the new plant will start soon and the installation of approximately 200,000 sq ft in area, will be erected on an 18-acre site near Metuchen, N. J. Structure will be of one story, brick and steel frame construction and will be completely equipped with automatic sprinklers.

Roseland, N. J.—Kidde Precision Tool Corp., a wholly-owned subsidiary of Walter Kidde & Co., 35 Ferrand St., Bloomfield, N. J., plans to construct a 67-acre industrial park contingent on approval by the Roseland Borough Council and Borough Planning Board. Plants to be built on the site will cost more than $5 million. Kidde's own 66,000-sq ft plant will occupy 10 acres of the tract, leaving 57 acres to be leased or sold to other buyers or tenants. Development plans call for the excavation of about four million cubic yards of rock and earth to prepare the site.

Totowa, N. J.—Yardley of London, Inc., 600 Palisade Ave., Union City, N. J., recently broke ground for a

(Continued on page 293)



A Partlow Model MFS indicating controller is shown in action in this "multiple exposure" shot of a Hole-Core Automatic Molding Machine manufactured by Spo, Inc., Cleveland, Ohio.

The Temperature Control Built to
SHRUG OFF SHOCK
2438 Times a Day

Every working day, the Partlow Temperature Control in this photo takes between 2400 and 2500 solid "roundhouse punches" from the shell-molding machine to which it is attached.

But despite jarring shock and vibration, and a constant barrage of foundry dust, the Partlow goes right on delivering precision control—without letup or breakdown.

Actually, only a control as simple and rock-solid as the Partlow could withstand this kind of punishment! Because only the Partlow contains no hairsprings, or delicate gadgets.

All Partlow thermal elements of the same range are interchangeable *on the job*, too. There's no time lost waiting for your control to come back from the factory. And you get this extra margin of dependability *without loss of accuracy*. Partlow controls are precise to within 1% of scale in any one of 10 ranges from –30° to 1100° F.

If you use or manufacture equipment within this temperature range, there's a Partlow to fit your application exactly . . . and save you money, too. Available in Pneumatic, Electric or Self-Contained Gas types, in recording, indicating or non-indicating models! To field test any Partlow control . . . or to obtain full details write, The Partlow Corporation, New Hartford, N. Y. Dept. PE-1060.

Export: Ad. Auriema, Inc., 85 Broad St., New York 4, N. Y.

A complete absence of gadgets and superfluous parts, as seen in this open view of the new MFS indicating control, explains the Partlow's unique ability to function accurately even under the most severe operating conditions.

You can pay more but you can't buy better than

PARTLOW

TEMPERATURE CONTROLS

For more facts circle 598 on Reply Card

Flintkote salesman Bill Schrand says...

"No matter what rolls through the plants you design– Flintkote's new Super Tuff-Tex® floor tile can take it!"

"There's no doubt about one thing: a better looking plant means a more efficient plant. And good looks start with a good looking floor. Your problem is to find an attractive floor that will keep its good looks throughout the years with minimum maintenance costs.

"Well, that's one problem you won't have to worry about if you install Flintkote's new Super Tuff-Tex floor tile in your plant. Tuff-Tex was developed specifically for industrial use. And it has stood the toughest tests over and over again. New Super Tuff-Tex is even better. It is a heavy-duty tile, strengthened with Asbestos — nature's permanent fiber. As a result, these tiles have greater strength— can shrug off plant traffic, including an amazing amount of trucking abuse— and roll with the punches from dropped objects.

"As for upkeep, Super Tuff-Tex is greaseproof, withstands oils, too. Its close-textured surface makes maintenance easier and economical. And, of course, Super Tuff-Tex is fire resistant.

"What about good looks? This year, Flintkote is introducing eight new, attractive colors. As you would expect from Super Tuff-Tex, the colors and marbleization go all the way through the tile, for long lasting beauty in your plant."

FLINTKOTE

TILE-TEX PRODUCTS

For particulars and literature, see your local Flintkote Flooring Contractor. You'll find him a great guy to work with; and he knows his stuff in flooring materials.

The Flintkote Company, Flooring Division, 30 Rockefeller Plaza, New York 20, New York

For more facts circle 599 on Reply Card

For more facts circle 600 on Reply Card ⟶

Photo courtesy Butler Mfg. Co., Galesburg, Illinois

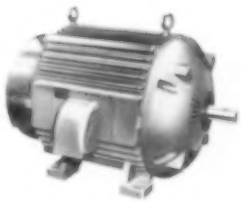
FOR EVERY APPLICATION, THERE'S ONE CRANE OUTSTANDING...

IN METAL FABRICATION . . . One man in the cab of this P&H overhead crane keeps several slitting and roll-forming machines supplied with coils of metal for continuous production. In addition, he spots incoming coils in proper storage areas as they arrive from the mills.

This manufacturer of standardized commercial buildings gets full use of plant floor area by moving materials through the air. The P&H crane and special coil-handling hook eliminates the "dead" aisle space needed with floor-operated equipment. It also saves manpower, and the safe, precision handling reduces damage to finished stock.

As with every Harnischfeger installation, this long-span (87') crane is specially engineered to consider all factors that may affect operation on this particular job. Special problems are taken in stride, integrated into the overall design. Only this kind of integrated engineering can give you performance that's never in doubt, performance P&H crane users have relied on for over 76 years! Why not find out more about P&H "job-engineered" cranes? Write for bulletin C-42, Department 124, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

All P&H motors are built specifically for crane service—not adapted to it! P&H engineers have designed extra ruggedness into every part for maximum efficiency under the most severe conditions of fast acceleration, frequent reversals, and repeated shock loads. Thousands of P&H crane motors in every-day use prove that they give years of trouble-free service with minimum maintenance.



P&H
OVERHEAD CRANES

HARNISCHFEGER
Milwaukee 46, Wisconsin

SPACE AGE MARGIN FOR ERROR – ZERO!

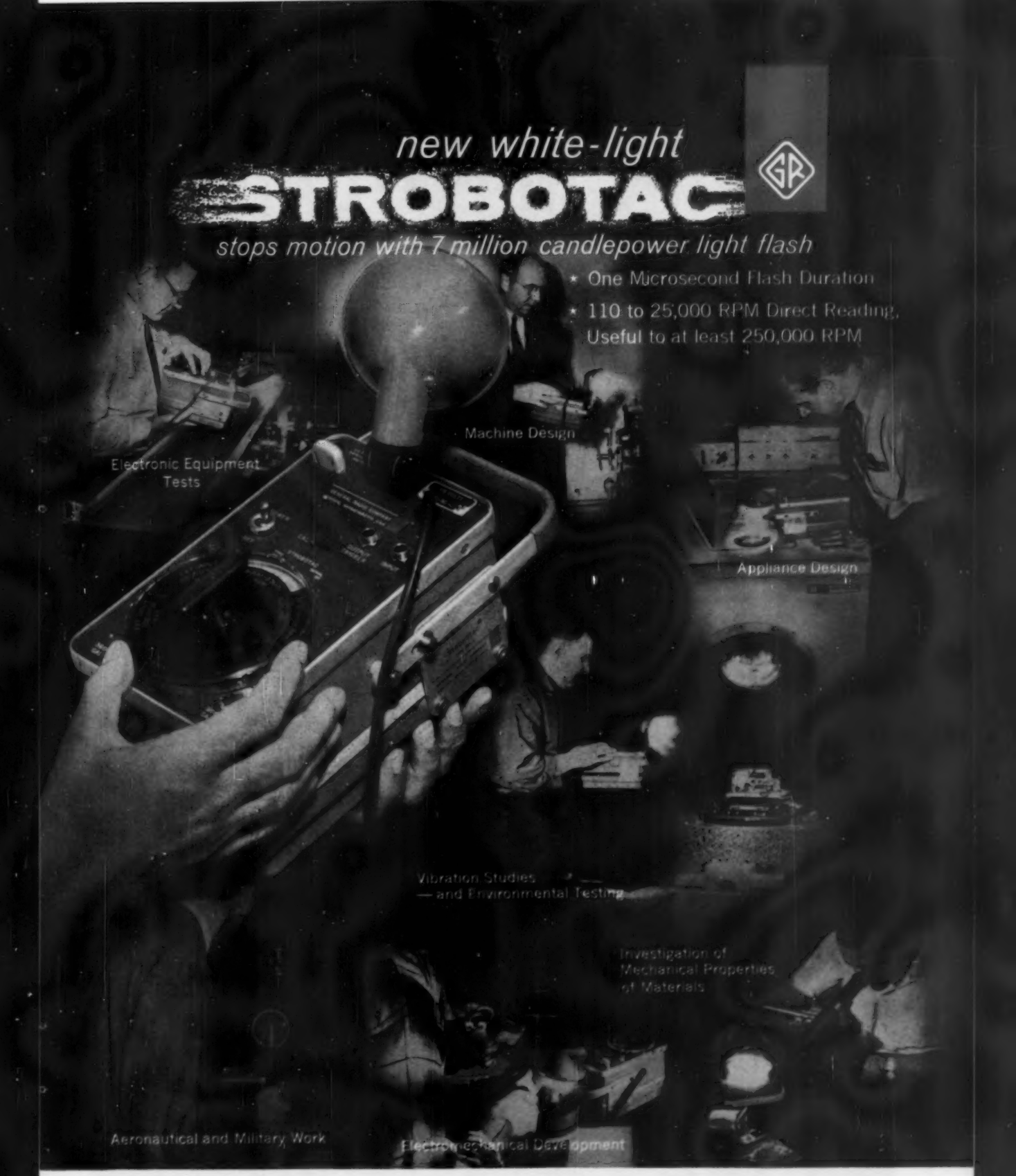
This P&H Zip-Lift® hoist carefully lowers a computer unit for a missile inertial guidance system into its special shipping container. Fast, safe, handling is vital with intricate assemblies like this. That's why so many component manufacturers depend on P&H Zip-Lift wire rope hoists. There is never any doubt about safety, reliability, or positive control.

You may not handle missile components, but isn't fast, safe, dependable, precision lifting and spotting just as important to uninterrupted production in your plant? If so, it will pay you to find out more about the P&H Zip-Lift's quality design features — dual brakes, 24-volt controls, shaved gears running in oil, permanently lubricated bearings, just to name a few.

Best of all, the price is down low enough to make a purchasing agent smile! Write for bulletin H-20, Department 226, Harnischfeger Corporation, Milwaukee 46, Wisconsin.

P&H
ZIP-LIFT HOISTS

HARNISCHFEGER
Milwaukee 46, Wisconsin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stops motion with 7 million candlepower light flash
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For more facts circle 601 on Reply Card

MODERN MAINTENANCE

IS PROFITABLE MAINTENANCE

R. L. Kirkpatrick, *Manager, Maintenance Sales*, Westinghouse Electric Corporation

What Do Your Maintenance Dollars Buy? Repairs Only... or Research Advances As Well?

Repaired equipment often beats its original performance. Why? Because large manufacturers like Westinghouse pass on to you the latest equipment improvements sparked by their research dollars. They make sure that repair facilities have engineering and quality control *in depth*.

If you judge solely on the basis of your repair bill, you may never know that your maintenance dollars could also include research advances. You can get radically new components, materials and techniques for your repair dollars that will lengthen operating life and cut your maintenance costs.

Building-in the findings of research means that your equipment is more than just repaired—it is modernized for maximum performance. This often means that your equipment can be rebuilt to work even better than when it was new. The latest advances in tech-

Westinghouse rebuilds "hopeless" motor

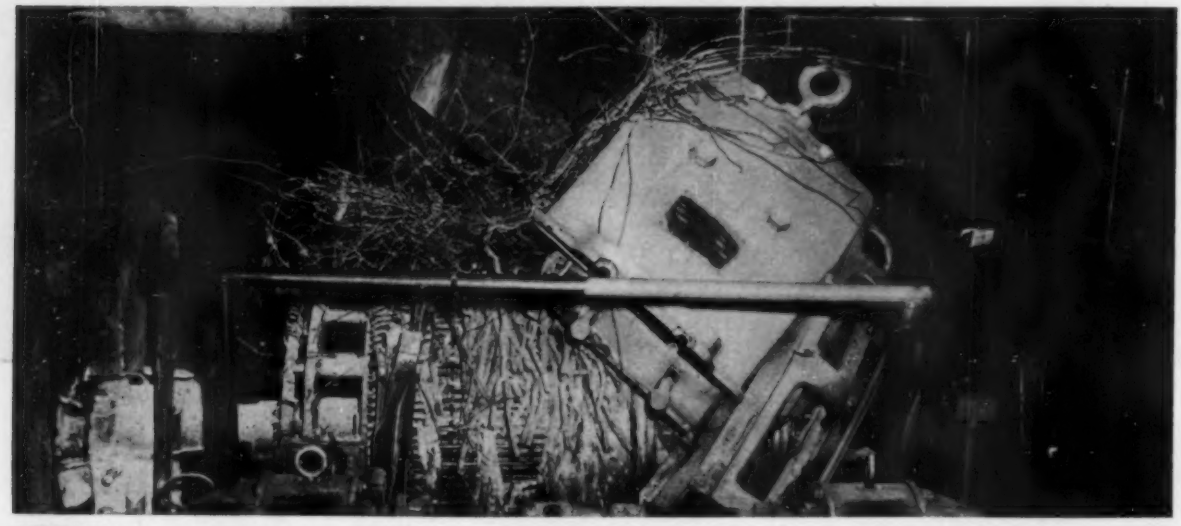
Repairs Save Customer Both Time and Money

It was a mess—this 720-hp motor serving a large steel company. Shaft shot. Armature damaged. Commutator gouged. Windings sprayed all around.

The accident occurred when a circuit breaker serving the motor jammed mechanically—failing to open when the motor lost its field.

Westinghouse maintenance experts from the St. Louis Repair Plant checked the motor carefully, decided that although the damage was extensive the motor could be economically rebuilt and put back in service in less time than replacement by a new motor. Meantime, a new Westinghouse motor, similar rating, recently delivered for a new mill, was pressed into temporary service to minimize down-time losses.

Westinghouse restored the motor to first class operating condition. Time required—a short 14 weeks. Savings to customer—estimated $11,000.



BEFORE: This sight greeted Westinghouse service engineers—a motor that apparently would never run again.

nology and engineering are incorporated in the maintenance service you receive—because large manufacturers are interested in your business in total, not just the immediate job on hand. They know that service and integrity go together—whether you buy new apparatus or need specialized service to maintain production equipment. It is imperative that they give you the latest, most modern and most reliable equipment.

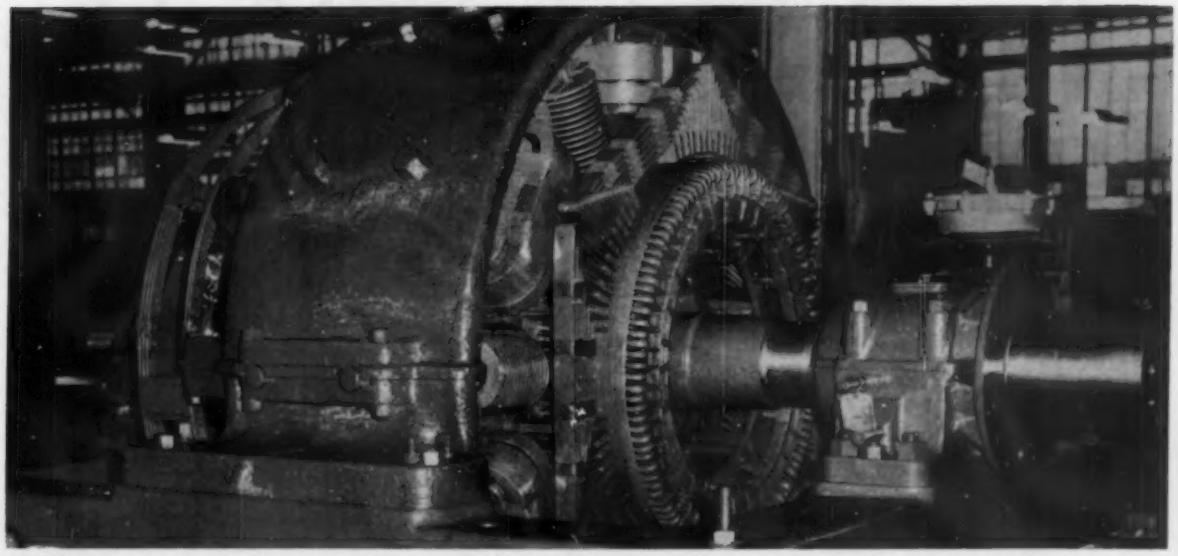
Millions of dollars are spent annually to solve equipment operating problems—to keep your equipment more reliable and on line with minimum down time. The tortuous testing of hundreds of materials (including devising the tests themselves) is constantly going on, to search for better materials and more economical ways to answer industry's needs.

Research often starts with maintenance because severe operating conditions put equipment to the supreme test. There is great advantage in working with a company experienced in solving problems under the many different conditions and in locations where they occur—even internationally. Knowledge gained in solving a particular maintenance problem becomes part of the sum total of experience that is applied to solving problems in *any* industry. It also leads to new products or equipment innovations that eliminate similar difficulties in the future.

A regular, planned schedule of modernization and repair—carried on in cooperation with a company such as Westinghouse—assures you of receiving the benefits of their research. Your equipment comes back to you with extended life that cuts maintenance costs . . . to help keep you producing profitably.

This is one of a series of Westinghouse articles on profitable maintenance practices.

—makes it better than when new



AFTER: The 720-hp motor, rebuilt and modernized by Westinghouse craftsmen, is now ready to go back on the line.

Westinghouse Maintenance Services —a Phone Call Away

Wherever you are, Westinghouse Maintenance Service is nearby, ready to work with you in the repair and modernization of your equipment—around the clock if necessary. In any industrial area of the country, you'll find Westinghouse Repair Plants, Renewal Parts Warehouses and Field Engineering Offices.

Your Westinghouse representative will show you how this fast, dependable, money-saving service can expedite your modernization and repair schedule . . . and he will assist you in setting up such a schedule. Call him . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. You can be sure . . . if it's Westinghouse. J-95219

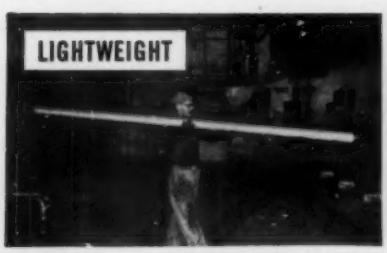
Westinghouse

Reynolds Aluminum Rigid Conduit LOWERS INSTALLATION COSTS

Here's why: Reynolds Aluminum conduit bends and forms easily and accurately. And, because aluminum is so lightweight—weighing one-third as much as steel, it can be handled and installed easily. Important to everyone concerned with maintenance is the fact that aluminum can't rust ever—and also resists corrosion due to weather and most industrial atmospheres. Even threads cut on the job can't rust.

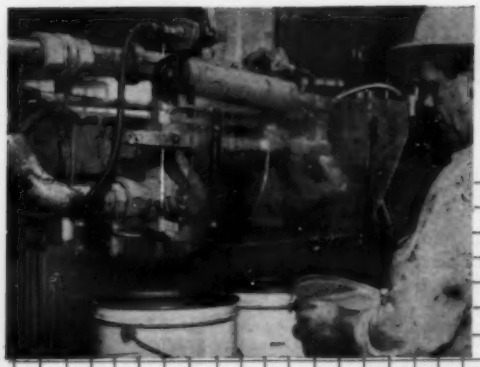
Reynolds Aluminum Rigid Conduit is non-magnetic, reduces voltage drop, makes longer runs or smaller conductors possible.

For complete information and names of Reynolds Aluminum Rigid Conduit distributors, call your Reynolds Sales Office or write *Reynolds Metals Company, Box 2346-ER, Richmond 18, Va.*

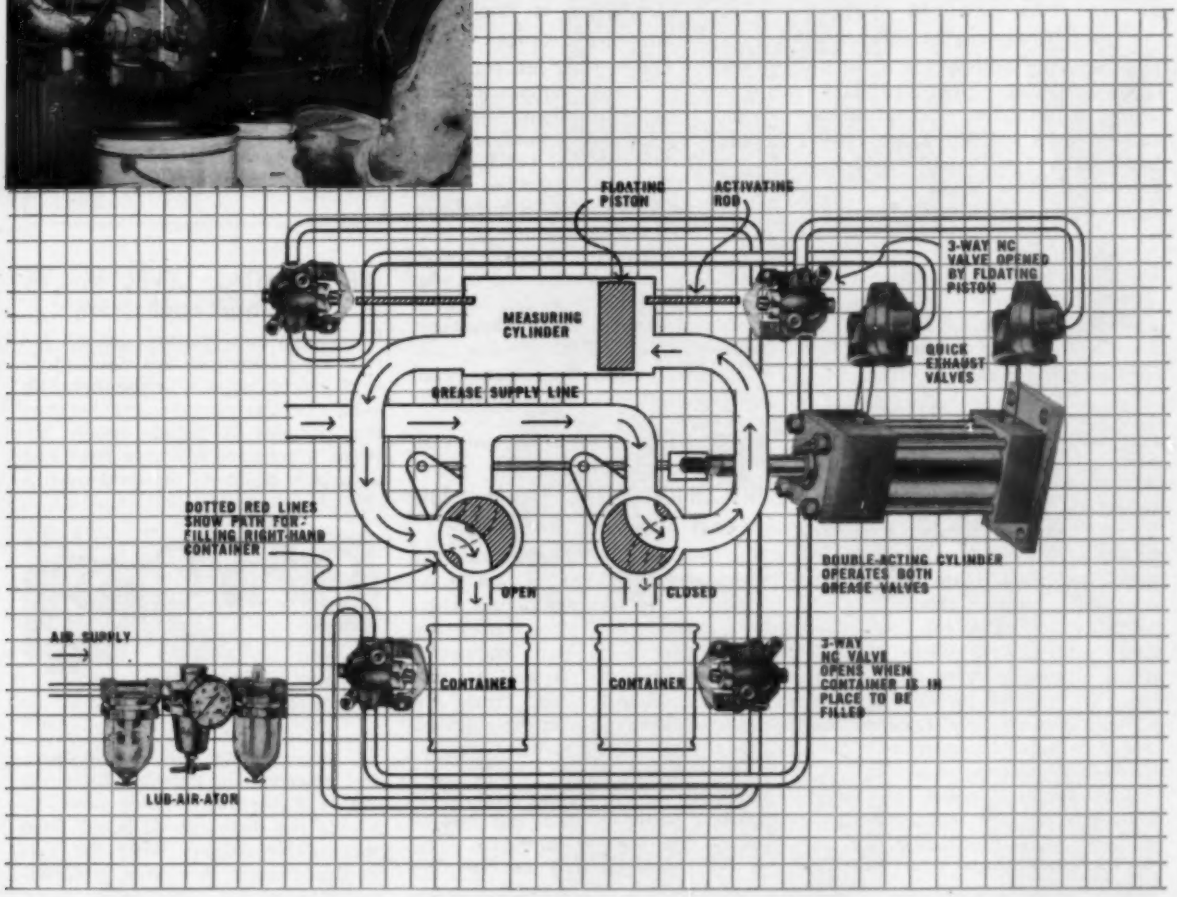


Watch Reynolds new TV show "Harrigan & Son", Fridays, starting October 7; also, "All Star Golf", Saturdays, resuming October 15—ABC-TV. And on Sunday, October 16, be sure to see the exclusive showing of America's new 1961 cars on The National Automobile Show, direct from Detroit over CBS-TV, 6 to 7 P.M. EDST.

For more facts circle 603 on Reply Card



Here is an example of Schrader at work. Barrett Mfg. Co. of Houston, Texas, makes grease handling equipment for Mobil Oil's Brooklyn, N. Y., refinery. This machine fills 35 pound grease drums automatically accurately, 15 per minute! George Barrett, who designed and built this machine and other machines for Mobil, says: "My reputation for quality is too hard-won to risk by using some inferior line of air products."



PACKAGING EQUIPMENT MAKER DESIGNS MACHINES TO ORDER...AUTOMATES THEM 100% WITH SCHRADER AIR PRODUCTS

In limitless combinations, Schrader Air Products are performing thousands of jobs in thousands of plants. Wherever jobs are messy, tricky, heavy, monotonous or complicated—it pays to talk to Schrader.

Air is already available to you. Put it to work—on your own operations, or on the equipment you make for resale, like the company shown above. Just tick off its advantages: high speed and accuracy, low cost and maintenance—plus safety, simplicity, dependability. Air can do almost anything fingers can—and many things fingers can't.

Both you and your customers want these benefits. Get them—and offer them—by actuating with Schrader—finest, most complete lines of Air Cylinders, Valves and Accessories.

Select from the full Schrader lines to plan your automation of machines. Your Schrader distributor can help you pinpoint what you need. For more data, write:

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QUALITY AIR CONTROL PRODUCTS

For more facts circle 604 on Reply Card

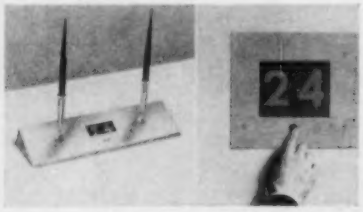
PLANT ENGINEERING EQUIPMENT®

Edited by M. E. Heniken

Readers Service Cards on pages 301-302 make it easy to get further information on any of this equipment. Just circle the item numbers of the products you would like to know more about.

SIGNALING SYSTEM features small annunciator screen

This signaling system has a miniatuized annunciator capable of indicating up to 100 different numbered signals—1 to 99 and 00—in a space no larger than 7 in. square. System is designed for use where needs of a large group—executives sharing in



stenographic or page pool, buyers interviewing sales people, security guards calling central station—can be served without installing large annunciators. Signals are displayed on telescreens small enough to be mounted into desk top, pen stand, small wall space. When signal is noted by dispatcher or other personnel, it is cancelled by pressing a reset button, automatically releasing next stored signal to appear on screen. Telestorage director panel controlling system contains power supply requiring a primary source of 110 v, 60 cycles. Auth Electric Co., Inc.

▲ For details, circle 1 on Post Card

PARTS CLEANER is low cost, automatic unit

Model 25 Cleanmaster Jet, Jr., is introduced as a fully automatic parts cleaner costing less than $100 and needing no air line connection. The compact, self-contained bench model features three cleaning actions: soaking and automatic multi-jet turbulence in the 10-gal tank; and automatic continuous filtered flow through flexible hose for precision cleaning on the upper shelf. Both areas can be used at the same time. Other advantages include: throw-away screw-in cartridge filter to keep the solvent clean; and fusible link in the cover to minimize fire hazard. Kleer-Flo Co.

▲ For details, circle 2 on Post Card

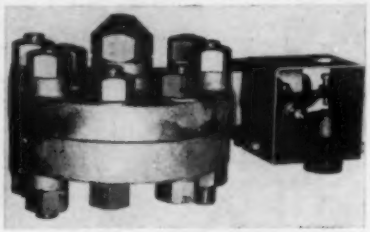
BRAZING TORCH uses low cost fuel, has hot flame

No. 19-S, a universal pressure torch with company's 1390 "H" tip, is designed for use with natural gas where brazing or silver soldering is necessary. It will operate on high, medium or low pressure, and is said to produce a hot, but clean, flame. The torch is claimed to offer three advantages over oxy-acetylene brazing torches: it uses lower cost fuel gas; the flame has a soaking heat effect; finished work is clean and free of carbon. The Harris Calorific Co.

▲ For details, circle 3 on Post Card

DIFFERENTIAL LEVEL VALVE has broad application

Variable system pressures do not affect the function of this differential-level pilot valve, it is announced. The valve operates on difference between two columns of liquid, usually between a constant reference head and a variable head. As the level rises in



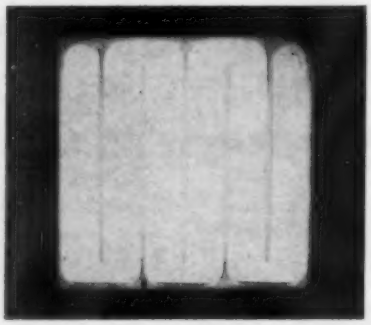
the variable column, this valve opens and releases air pressure from the top of a diaphragm motor valve, allowing the discharge of liquid from the variable column. When the level in this column falls to a pre-determined level the valve again closes, and the cycle repeats. The principle can also be utilized with a steam trap to operate over a wide range of pressures. Besler Corp.

▲ For details, circle 5 on Post Card

FLUORESCENT LIGHT in flat, rectangular form

To be mass produced as soon as manufacturing equipment is completed, are large thin, rectangular glass plates no more than 1½ in. thick, which produce fluorescent light. The lamps consist of a labyrinth or maze of passages sealed in a thin glass block to produce, in effect, a large area source of light. The prototype which manufacturer plans to market is a 1-ft square, about 1½ in. thick, with compact rear contacts. It is designed for use in modular fashion and said to have good light output and efficiency. The 12-in. square models will be 40- to 50-w lamps and will produce considerably more light than a 100-w incandescent bulb, according to company.

Initial models will have a reflector on one side, so all light will be reflected through a single side. Pattern glass will be used on the front of the lamp to control brightness and direction of



light. In addition to their decorative and functional possibilities, the new lights will take less ceiling space for mounting. They require only a skeleton fixture with practically no depth. Also, they require less maintenance; fluorescent, reflecting and diffusing elements are combined in one, and it is necessary only to clean the outer glass surface. Westinghouse Electric Corp.

▲ For details, circle 4 on Post Card

PRE-FAB BUILDING for multi-purpose use

Adaptable for general warehousing, storage, office, plant production and other uses, the all-steel Spartan is designed for fast assembly and low upkeep. While it can be built on concrete foundations, it can also be erected without a foundation where floors and foundations are not essential. Planned to conform with most building codes, the Spartan is available in a standard model with 12-lb snow load and 15-lb wind load, as well as a heavier model with 30-lb snow load and 20-lb wind load. The Spartan has low-pitched roof design to enable greater widths, and uses any combination of sliding and walk-

Now . . . pull the fan wheel or motor while DeBothezat® Bifurcator® Fan remains in duct.

Not just an access door. Half the entire cone comes off.

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For more facts circle 605 on Reply Card

PLANT ENGINEERING EQUIPMENT

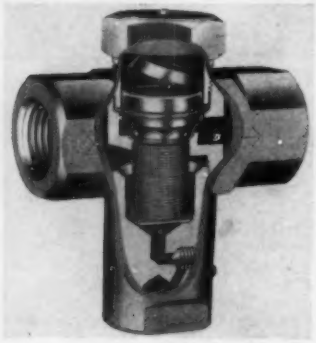
(Begins on page 214)

in doors, skylights, windows and ventilators. It comes in widths of 12-ft multiples, enabling buildings up to 72 ft wide. Lengths start at 32 ft and come in multiples of 16 ft. There are three basic heights: 10, 12 and 14 ft. Martin Steel Corp.

▲ For details, circle 6 on Post Card

IMPULSE STEAM TRAP for light condensate service

Strainer and blowdown valve are combined in one body in the Yarway No. 130 Impulse Steam Trap. Designed for light condensate loads with steam pressures from 8 to 600 psi, this trap requires only two connections. Manufacturer states that by eliminating separate strainer and lowdown valve and their necessary fittings, it offers potential installation savings of up to 30 per cent, reducing pipe connections by as many as six. The trap employs the thermodynamic principle of steam trapping in which the valve disc snaps open to discharge condensate but closes on steam. It is furnished with ½-in. pipe connections. This design places the blowdown valve ahead of the strainer screen and trap. Opened

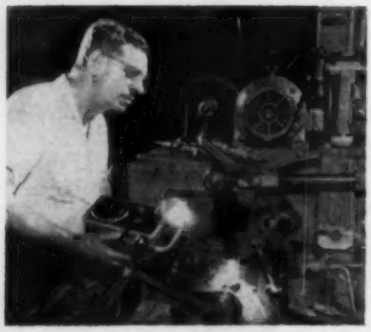


and closed by an Allen wrench, the blowdown valve has a threaded outlet for applications where it may be desirable to pipe blowoff away from the immediate area. Company recommends this trap for steam main drips, steam tracer lines, and other similar light condensate installations. It is expected to prove most advantageous for new equipment where it simplifies piping and reduces installation time and costs. Yarnall-Waring Co.

▲ For details, circle 7 on Post Card

STROBOSCOPIC TACHOMETER "freezes" a machine's motion

Type 1531-A, a small and portable version of this company's Strobotac, is announced as featuring a fundamental-speed (flashing-rate) range of 110 to 25,000 rpm and brilliant white flashes with extremely short duration (3 microseconds or less) so that fast action can be "stopped." The extremely short flashes can be used to freeze high speed motion of such rotating and reciprocating machine elements as cams, pulleys, governors, gears, fans, linkages, pawls, sprockets and chains. No mechanical contact is required with the machine being measured, and thus no power is absorbed and the machine's operation is not affected. A Strobotron lamp produces the high-intensity flashes with praks of 0.21, 1.2 and 4.2 million candlepower on three ranges: high (4000-25,000), medium (670-4170) and low (110-690). Single flash-rate peak is 7 million candlepower. Speeds to 250,000 per minute can be measured by using flashing rates that are submultiples of the speed to be measured. Form 3032-A describes the instrument. General Radio Co.



▲ For details, circle 10 on Post Card

COAGULANT AIDS promote efficient solids removal

Aquafloc Coagulant Aids are introduced for removal of suspended and precipitated solids from water in sedimentation tanks, clarifiers, softeners or filters. They cause individual particles in water to gather in dense flocks. As solids gather into larger, heavier masses, they settle faster, filter better and give better water clarity, company points out. Included are Aquafloc 420, a non-ionic type, Aquafloc 422, which may be used in potable water systems, and Aquafloc 425, which has an anionic form claimed to produce excellent results when floc is positively charged. Dearborn Chemical Co.

▲ For details, circle 8 on Post Card

DIFFUSING ELEMENT has a "three-in-one" lens

An apparent depth of only 2½ in. makes the shallow Coronado particularly adaptable to interiors requiring high quality illumination in an attractive ceiling mounted lighting unit. It features a three-in-one lens which incorporates an L-120 prismatic diffusing lens on the bottom, a linear refracting lens on the sides directing light out of glare zone, and a refracting lens on top to eliminate ceiling "hot spot." Units are designed for surface mounting and come in a white Prisopal lens and clear polystyrene lens. The lens is a combination of low brightness prismatic lens with two linear refracting lenses all in a one-piece diffusing element. Benjamin Div., Thomas Industries Inc.

▲ For details, circle 9 on Post Card

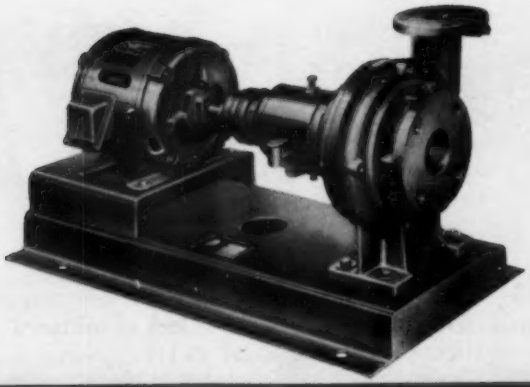
AIR MOVER for exhausting welding fumes and smoke

The Flex Air Mover is a device for exhausting welding fumes and smoke from closed work areas, comprised of an intake nozzle joined to a jet pump casting by a length of flexible tubing. From this point, smoke is exhausted through another connecting section of tubing to any discharge point. It is powered by compressed air. Operation requires merely connecting it to any air line positioned to carry smoke and fumes away from work. Arcair Co.

▲ For details, circle 11 on Post Card

SEALER keeps blacktop surfaces "alive" longer

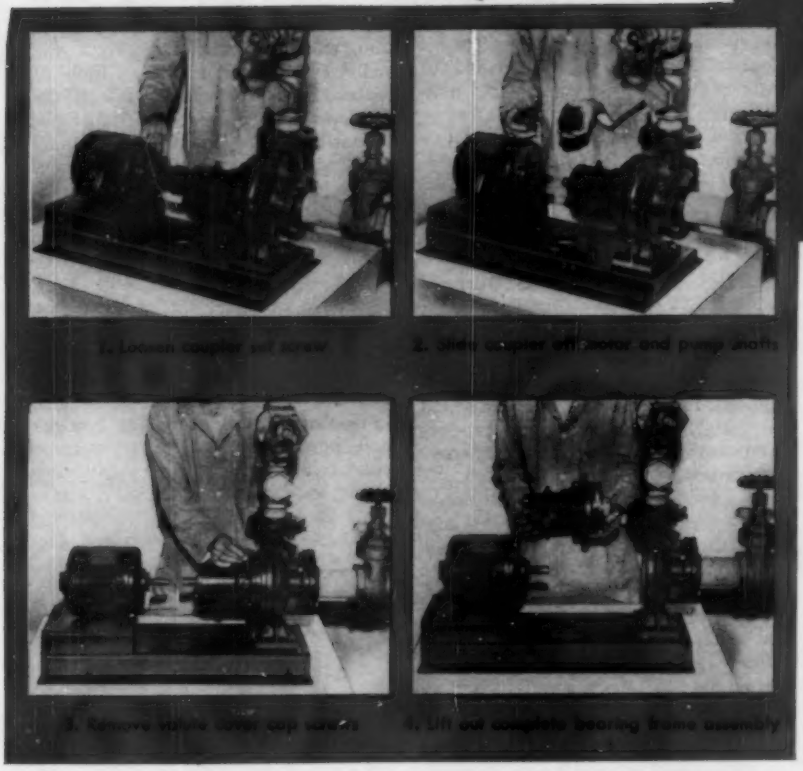
Careysealer is an asphalt coating for blacktop driveways and parking areas. It comes ready to apply from the original container, and when properly applied, is said to keep the pavement "alive" and extend its service life by many years, preventing hairline cracks and oxidation and improving appearance. It provides a hard, rugged surface that won't soften or track during summer heat, says manufacturer, and is safe to use because it is applied cold and does not contain



EASY TO SERVICE

THIS VERTICAL SPLIT CASE PUMP offers all the advantages of horizontal split case pumps

B & G SERIES 1510-B CENTRIFUGAL PUMP



The photos show how easily the complete bearing frame, including seal and impeller, can be removed without disturbing piping or motor leads. The unit is replaceable and interchangeable in all pump sizes within limits of material construction.

Other features of the 1510-B include—

Mechanically balanced impeller. Balancing chamber and pressure relief holes in the impeller reduce thrust to a minimum, lengthening pump life.

Solid-type volute with support foot. Can be left in pipe line when servicing pump—rugged construction absorbs piping strains.

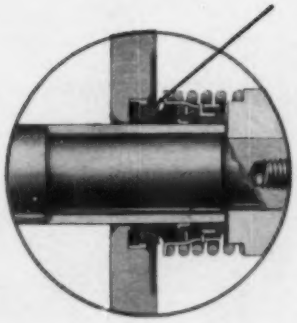
Anti-friction roller bearings. Timken bearings handle thrust and radial loads for smoother, quieter, more efficient operation.

Oil lubrication. No messy, undependable grease cups—circulating oil lubrication assures positive protection to bearings. Oil level indicator permits visual check.

Rugged steel base. Base mounted construction provides a sturdy platform for proper pump and motor alignment.

100% factory tested. Every pump hydraulically tested to meet specified conditions of head and capacity.

Capacities. To 2000 GPM, heads to 420 ft. 1¼" through 8" discharge.



LEAK-PROOF REMITE® SEAL

...eliminates the customary leakage which occurs when a packing gland is used

This exclusive feature assures long, trouble-free life. A carbon seal ring faces on a "Remite" floating seat—a material developed by B&G, so hard it will scratch glass—wear-proof and corrosion-resistant.

This mechanical seal is self-lubricating. A synthetic rubber bellows seals the shaft. Metal parts are of steel, bronze or stainless steel, depending upon the type of service.

STOCK PUMPS FOR QUICK SERVICE

Selected sizes of B&G Series 1522, 1531 and 1510-B Centrifugal Pumps are stocked at the factory for immediate shipment. Capacities to 550 GPM, heads to 180 ft. Send for Price and Selection Catalog.

BELL & GOSSETT COMPANY

Dept. GJ-53, Morton Grove, Ill.

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

Reg. U.S. Pat. Off.

For more facts circle 606 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

flammable solvents. A gallon coats about 80 to 100 sq ft of blacktop surface. To apply, you sweep the area to be covered, flush it with clear water and brush on the coating sparingly with roofers brush or broom. The Philip Carey Mfg. Co.

▲ For details, circle 12 on Post Card

ENCLOSED FIXTURE gives even, unobtrusive lighting

The Lyric features a large polystyrene plastic dish shielding with softly molded corners. The shielding extends beyond the housing sides to create a neat appearance and illumi-

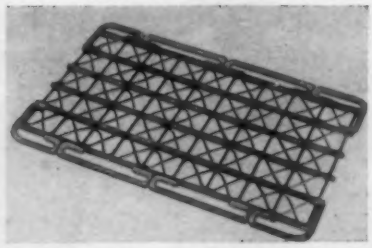
nate the sides. The Lyric is available as a surface unit or as coffered unit, with fiberglass plastic flanged coffer shell, or with a coffer for plaster ceilings. It comes in 2-by-2, 2-by-4 and 4-by-4 ft. sizes. The shielding is available with plastic louver insert, or as a regular one-piece shielding. For easy maintenance, the shielding hinges and opens from either of two sides. Smithcraft Lighting.

▲ For details, circle 13 on Post Card

ALL-PURPOSE CLEANER for dust free environments

Aidco 66 is a non-ionic cleaner claimed to reduce static electricity and prevent dust deposit due to build-up of such charges. According to test reports, Aidco 66 effectively cleans in salt, fresh, hot or cold wa.er and is harmless to skin, clothing, paint and varnish. It is sold in concentrate—you use a tablespoon or two to a gallon of water. Alloy Industries Development Corp.

▲ For details, circle 14 on Post Card



PROCESSING TRAYS resist heat and corrosion

BI "X" Trays are claimed especially adaptable for brazing, annealing, sintering and heat treating applications. Weighing less than 4 lb per square foot of surface, and constructed of round material, the trays are non-welded. They are engineered to be reversible—giving two usable surfaces. Bix Co.

▲ For details, circle 15 on Post Card

FILTER REGULATOR for control system application

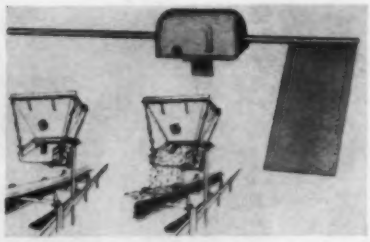
Announced as lightweight and economical, the 080 Filter Regulator is suggested for use wherever a controlled supply of clean air or gas is needed. It is claimed especially suited for single unit hookups and production equipment, air chucks, spray equipment, gas drives, instruments and air cylinders. Of die cast aluminum, this unit has a maximum inlet pressure of 250 psi and outlet pressure ranges of 0-5, 5-35, and 35-100 psi. Optional construction includes handwheel adjustment and ¼-in. side outlet tap for pressure gage mounting. Construction and performance are same as company's standard instrument regulator with the exception of the body, which has been modified with a filter bowl. This bowl contains a replaceable filter cartridge made of wool fiber, and a ⅛-in. drain valve at the bottom of the bowl. Meter and Valve Div., Rockwell Mfg. Co.

▲ For details, circle 16 on Post Card

PLATFORM LADDER is non-conductor of electricity

The Alco-Lite P400 Fiberglass Safety Platform Ladder is a non-conductor of electricity as well as being non-absorbent. It is designed to provide maximum safety around high voltages and resist damaging effects of moisture, chemicals, acids, fumes, and gases. High tensile strength aluminum steps, platform and fittings are riveted to fiberglass siderails. Steps and platform are of non-slip design. It is available in heights from 4 to 10 ft. Aluminum Ladder Co.

▲ For details, circle 17 on Post Card



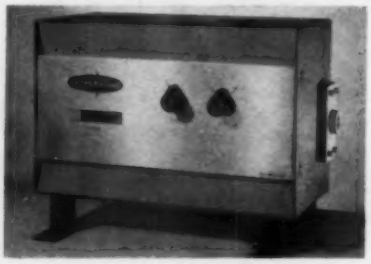
FLOW SWITCH responds to lack of material

Model FS-1 Flow Switch is designed to respond to the lack of material at a critical point in a bulk handling system and automatically correct the difficulty or sound an alarm. Flow of material past the switch deflects the flap and holds it out of operation position. When the flow stops and there is none to hold the flap in a deflected position, it swings back into operating position and actuates the switch. The latter may start an electromagnetic bin vibrator, vibratory feeder etc. to start material flow. Or an alarm, manual or audible, can be set up by using the flow switch as energizing agent. A number of switches can be used in one system. They can be installed in feeder and conveyor troughs; in discharge openings of bins, bunkers and hoppers; in angled or vertical connecting chutes; in discharge chutes of dryers, crushers, ball mills. Actuating angle of the flap as it affects the switch is adjustable through 360 deg. Switch rating is 1 amp at 115 v, 0.5 amp at 230 v. Syntron Co.

▲ For details, circle 18 on Post Card

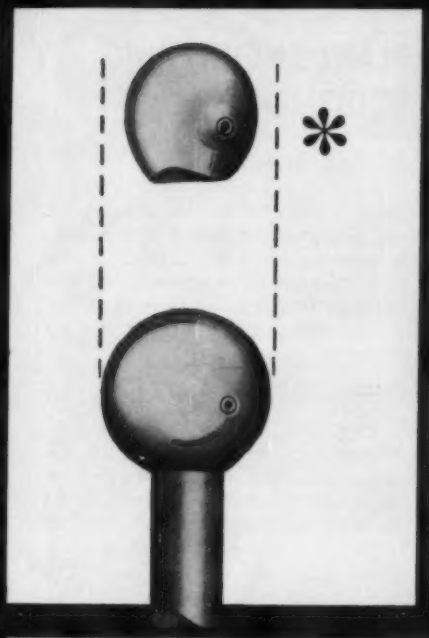
GAS DETECTOR operates on mechanical balance principle

The Detectogas Air Density Monitor operates on a mechanical balance principle, which allows it to work around the clock without power or an attendant. Explosion-proof switches can activate any type of alarm system



when changes occur in air density due to gas accumulation, it is stated, and the unit automatically compensates for changes in temperature, humidity and atmospheric pressure. It can be installed wherever an accumulation of industrial or heating

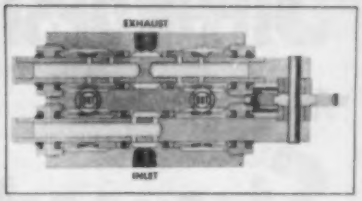
For more facts circle 607 on Reply Card ——→



after 17 years... replacement parts ***one handle ball!***

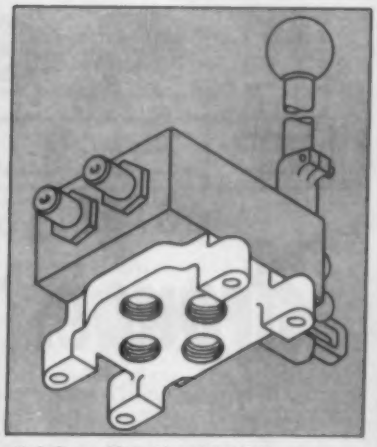
Human hands wore this metal handle ball to a fraction of its original size before the customer returned the valve to us for reconditioning. This high pressure hydraulic valve performed faithfully for nearly two decades with only such minor maintenance as replacement of "U" packing. We replaced the handle ball, repacked it, cleaned it up, and sent it back. This kind of trouble-free service is typical of Hunt hydraulic valves.

¾" MS-551-N4



The Higher the Pressure The Tighter the Seal

Cross-section view shows Hunt system of "U" packing as opposed to "metal to metal". "U" packing provides zero leakage on water hydraulic service.



Sub-Base Mounting Simplifies, Speeds Up Maintenance

New sub-base mounting is now available on all Hunt hydraulic valves. Easy, quick replacement for maintenance with no disconnecting of pipes.

HUNT V H C

HUNT VALVE COMPANY DIVISION OF IBEC SALEM, OHIO

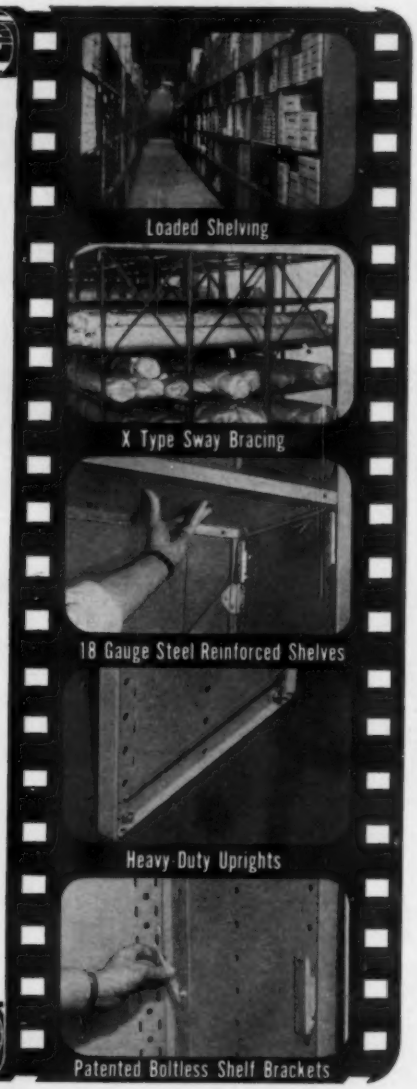
Quick-As-Wink AIR & HYDRAULIC CONTROL VALVES

Strongest *for greater capacity*

Strongest *for longer life*

Strongest *for more protection*

Strongest *for lasting appearance*



DELUXE
STEEL SHELVING

strongest *because . . .*

. . . it is made of 18 gauge steel, and has both side and back cross-bracing. Factory embedded reinforcing in the shelves prevents damage under large or concentrated loads; one piece bin type uprights give you strength where needed.

The film strip shows 5 engineered features of Deluxe steel shelving that contribute to its strength and durability. In addition, Deluxe steel shelving, with patented boltless shelf brackets, is fast to assemble, fast to rearrange. Call your local Deluxe dealer for details or write us for the new Deluxe Shelving Catalog #284.

ROYAL METAL MANUFACTURING COMPANY
DELUXE METAL PRODUCTS DIVISION • 1 PARK AVE., NEW YORK 16

Royal®

For more facts circle 608 on Reply Card

PLANT ENGINEERING EQUIPMENT

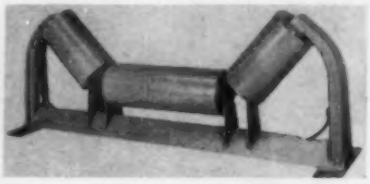
(Begins on page 214)

gases could jeopardize human life and property. According to company, it sells for less than a third of the cost of existing equipment for this purpose. Detectogas Instruments, Inc.

▲ For details, circle 19 on Post Card

DEEP TROUGH IDLERS for heavy, light materials

Additions to company's line of 35- and 45-deg deep trough belt conveyor idlers offer possibilities for economical handling of materials that formerly required 20-deg idlers, due to their greater capacity. With the 35-deg idlers, such heavy materials as coal, sand, gravel, crushed stone and ores



can be handled, company says, while the 45-deg idlers (shown) are designed to handle lighter materials such as grain and wood chips, but under certain conditions can be applied for heavier materials. Book 2716A describes these idlers. Link-Belt Co.

▲ For details, circle 20 on Post Card

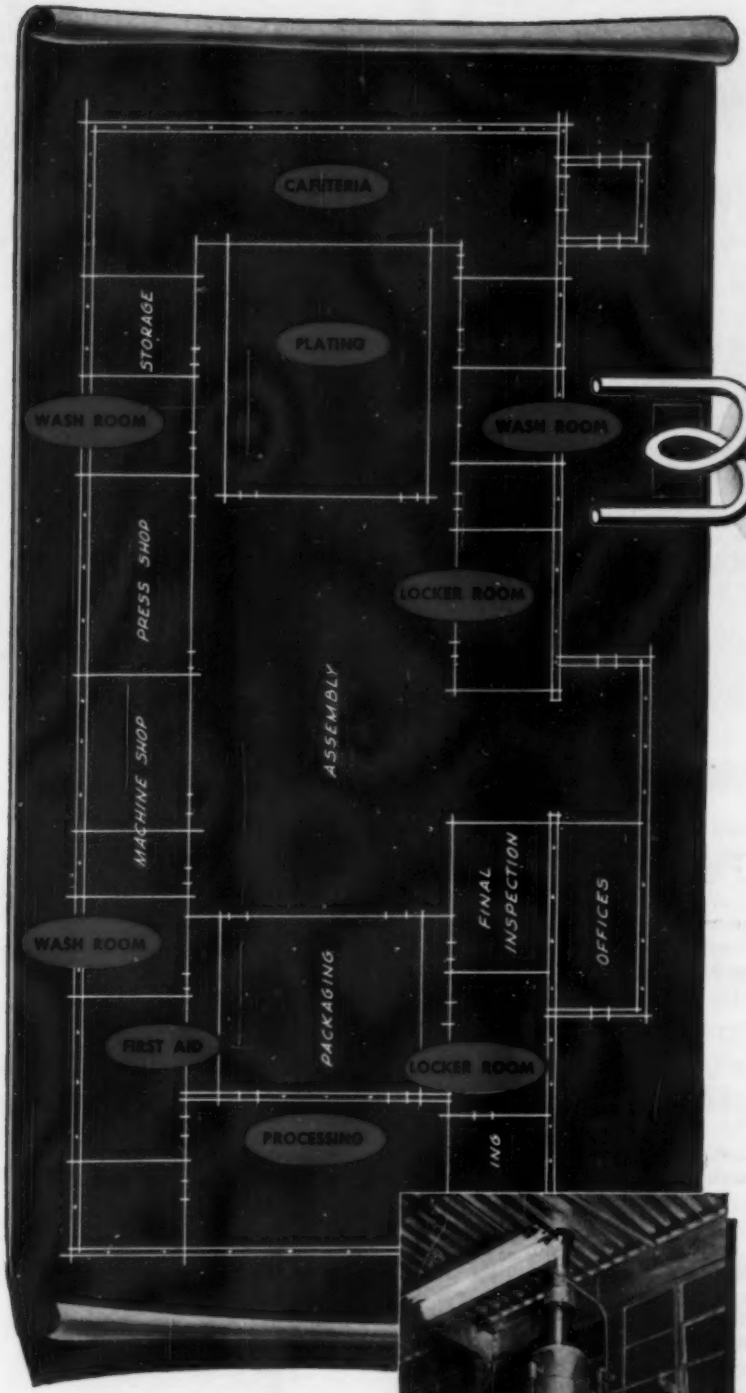
BRONZE VALVES with 2500-psi working pressure

These hydraulic bronze globe and check valves have working pressures of 2500 psi cold water, oil, or gas (water and oil ratings are non-shock). Other features announced include: 45-deg seat (flat to flat), 1½-and 2-in globe valves furnished with bolted bonnets with O-ring gasket, and handwheels instead of lever handles. Crane Co.

▲ For details, circle 21 on Post Card

BRAKE MOTOR for use on hoists, cranes, conveyors

The Thinline Brake Motor, which is 6 in. shorter and 20 lb lighter than standard brake motor designs of equivalent ratings, is designed for use on hoists, cranes, conveyors, machine tools, printing presses, laundry equipment and saw mills. Frame and end-shields of the motor are of rigid cast iron constructions. The Thinline is



AMPLE HOT WATER ... *on the spot!*

WITH **Burkay®**

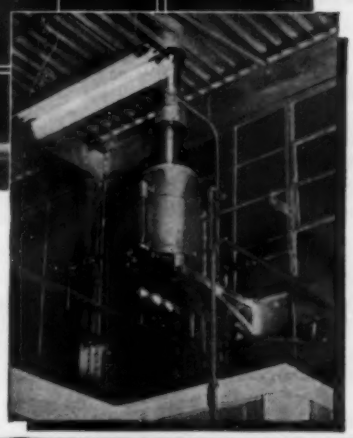
GAS-FIRED INDUSTRIAL WATER HEATERS

Far from being centralized, most industrial hot water needs are usually scattered throughout the plant.

Not only that, but it's more than likely that each application has its own specific requirements with regard to volume, temperature and "peak load" characteristics.

That's why more and more industrial operations are including *Burkay* gas-fired water heaters in their modernization plans. One or more *Burkay* units can be easily "spotted" at each point-of-use . . . to provide maximum flexibility, a dependable supply of right-temperature hot water for each specific need, and substantial savings due to the elimination of costly piping losses and inefficient "small-load" boiler operation.

Learn now how *Burkay* industrial water heaters can help solve *your* hot water problems. Contact your A. O. Smith-*Burkay* Distributor without delay, or simply return the convenient Reader Service card provided by this magazine.



Compact and lightweight, Burkay industrial water heaters can be easily installed in out-of-the-way places—even mounted on a shelf. Units available in a full range of sizes up to 420,000 BTU per hour (approximately 10 HP). Efficient copper construction includes unique fin-and-tube heat exchanger and water-wall combustion chamber for long life and economy of operation. Units available for use with all gases. All Burkay coil-type industrial water heaters are A.G.A., C.G.A. and C.S.A. approved, and all bear the A.S.M.E. seal.

Through research ...*a better way*

A.O.Smith
CORPORATION

PERMAGLAS DIVISION
KANKAKEE, ILLINOIS • NEWARK, CALIFORNIA
A. O. SMITH INTERNATIONAL S. A., MILWAUKEE 1, WIS.

makers of famous **Permaglas** *glass-lined water heaters, warm air and hydronic heating equipment*

For more facts circle 609 on Reply Card

. . . and for

NEARBY SERVICE on Black & Decker tools.

Black & Decker maintains 50 factory service branches plus authorized service stations to give your B&D tools the attention mechanical products need periodically. Keep your B&D tools in top condition, on the job all the time.

Only factory parts and factory-approved methods are used. Fast service and reasonable cost, always.

SWIFTY SERVICE says be sure to ask about:

FREE TOOL INSPECTION no cost, no obligation.

STANDARD B&D GUARANTEE after completion of all recommended repair work.

You'll find the location of the nearest B&D repair facility in the Yellow Pages under "Tools-Electric," or write for address to: THE BLACK & DECKER MFG. CO., Dept. 0810-S, Towson 4, Md.

50th YEAR

See Tools-Electric-Yellow Pages-for Service & Sales

Black & Decker

Quality Tool Service

For more facts circle 610 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

available in polyphase ratings of 1 to 5 hp at 1800 rpm, ¾ to 3 hp at 1200 rpm, and ½ to 2 hp at 900 rpm. General Electric Co.

▲ For details, circle 22 on Post Card

PORTABLE SPACE HEATER is indirect fired, vented

Model 120 is an indirect fired "vented" portable space heater designed for use in confined areas where fumes are objectionable, circulating 1885 cf of

heated fresh air per minute. It has a 15-hr continuous burning capacity, fuel filter, high heat cut-off switch and automatic purging. Heaters burn kerosene or number one fuel oil and operate on standard 110 v a-c. Champion Mfg. Co.

▲ For details, circle 23 on Post Card

More information on any of this equipment can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 301-302.

LIQUID LEVEL CONTROL stands vibration, corrosion

Designed to provide liquid level control in most locations where vibration and corrosion are serious problems, Model 752 Magnetrol is a single-stage, external float cage style control. It can be electrically or pneumatically switch operated. A new electric switch mechanism (the S-6), designed for this control is a magnet-actuated, two-position, snap-action mercury switch, with anti-vibratory features. Its angle of magnetic swing has been increased to provide a greater angle of tilt to the mercury switch, to eliminate splashing of mercury across the contacts under severe vibration. The rocker arm dual magnet action allows holding action in either switch actuating position.

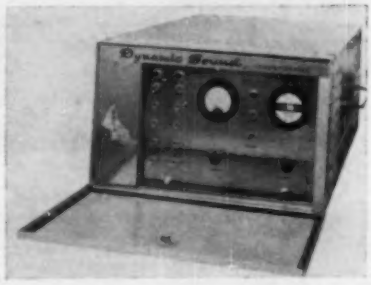
For applications where pneumatic switch operation is required this control can be equipped with a non-bleed, pneumatic switch mechanism (the J-2). It is a magnet-actuated, two-position, snap-action pneumatic switch designed not only to provide positive snap action for both "on" and "off" positions, but also to utilize magnetic

(Continued on page 225)

H-F SOUND DEVICE chases the rats out of the building

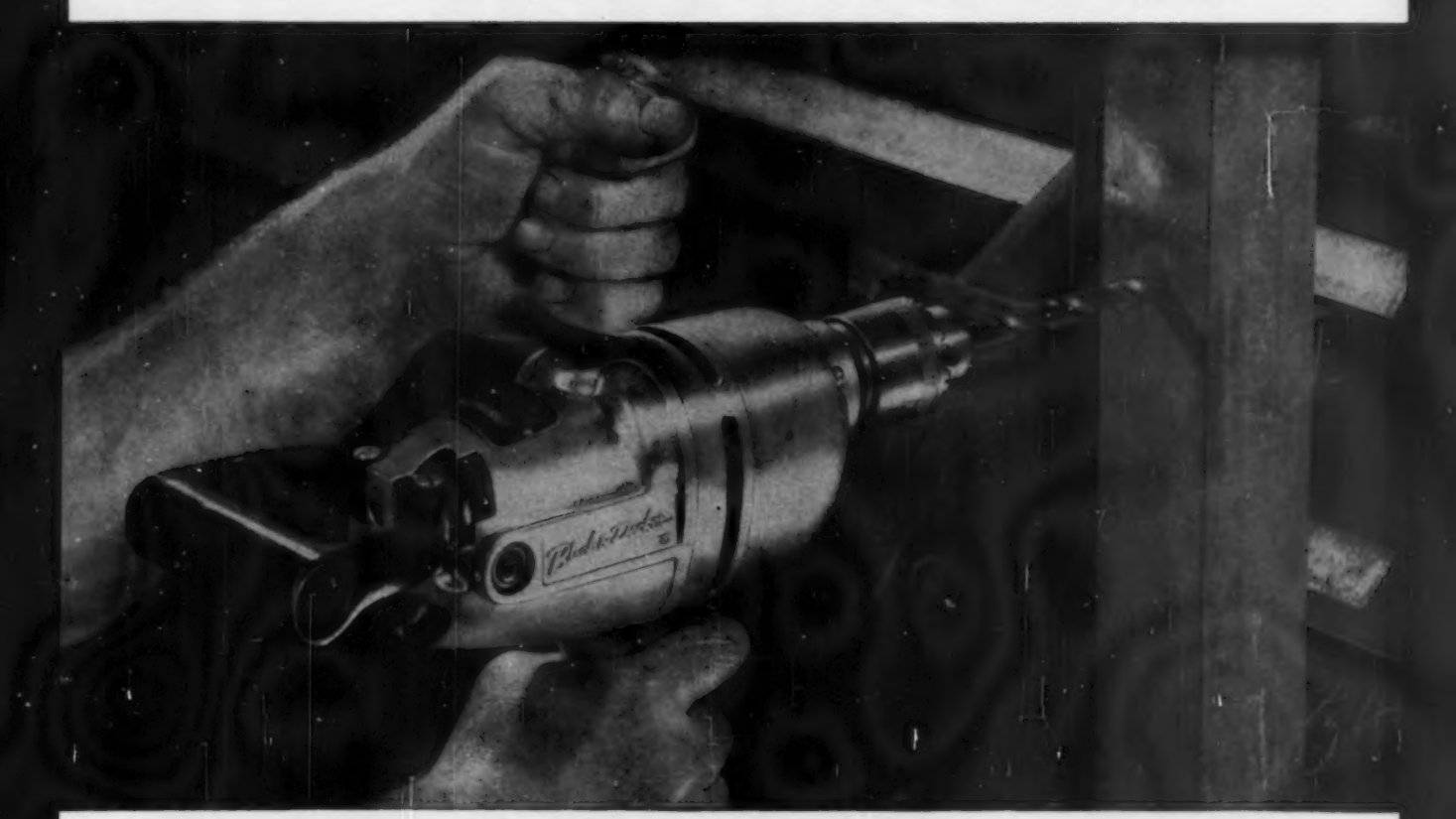
Claimed to clear a building of rats within 72 hr, this high frequency sound device fights rats with an incomprehensible force which they can hear, but cannot see, smell, taste or outwit. Their only means of escaping its nerve-shattering electrical impulses is through terror-stricken flight. During their flight the rats become vulnerable to other, traditional extermination devices, it is pointed out. Powdered poison can be placed over "runs" or known exits from a building where it cannot be avoided during the exodus, the poison taking effect after rats have left the building.

Vibrations at which the machine broadcasts are of such high frequency they can be heard only by rats and mice, manufacturer states; they have no effect on persons or household pets. A feature noted is that rats cannot build up an immunity to the broadcasting because the sound pressure waves are erratic in range, not duplicating the same pattern until long after a rat's endurance limit. A sound dispersal unit measuring only 20-by-31½-by-12 in. can serve up to 120,000 sq ft of building area with the



aid of transducers or speakers as required. A time clock mechanism permits scheduled broadcasting dispersal hours, particularly at night, when rodents are most active. The machine can be purchased or leased. Dynamic Sound, Inc.

▲ For details, circle 24 on Post Card



Light in your hands, tough on the job!

MOST POWERFUL DRILL of its size available, the Black & Decker ¼" Standard. Powered to pull a locomotive with full power in reverse; positive drive chuck.

TREMENDOUS TORQUE developed by this ½" H.D. Holgun® takes on the tough ones with ease. Compact to work in tight quarters, this tool's a "best buy."

DRILLS UPSIDE DOWN! B&D Magnetic Drill Presses stick like glue in any position; operate manually or with exclusive remote control. 1¼" or ¾" capacities.

POWER NEARLY DOUBLED in B&D ¼", ⅜" and ½" End Handle Drills gives you more performance for the price . . . better control for heavy-duty applications.

Make those heavy drilling jobs go quicker, easier . . . with the lightweight Black & Decker ½" Special Drill. Its precision-balance, compactness and years-ahead design make handling easier yet. And, of course, famous B&D rugged construction proves itself right through any job.

No matter if you're drilling a small hole in trim or a large hole in structural steel . . . you can find the drill you need, from ¼" thru 1¼", in the line preferred throughout industry—Black & Decker. You always get the best motors, the finest construction, the newest features (such as, full power in reverse). Why not see the complete line?

Leading Distributors Everywhere Sell

50th YEAR **Black & Decker®**

QUALITY POWER TOOLS

MAIL COUPON FOR FREE DEMONSTRATION

THE BLACK & DECKER MFG. CO., Dept. 0810
Towson 4, Md. (In Canada: Brockville, Ont.)

☐ Please arrange for a demonstration of the following drill(s).....

☐ Please send me additional information on .....

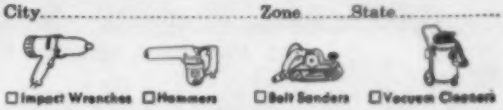
See "Tools-Electric" -Yellow Pages- for Service & Sales

Name..... Title.....

Company.....

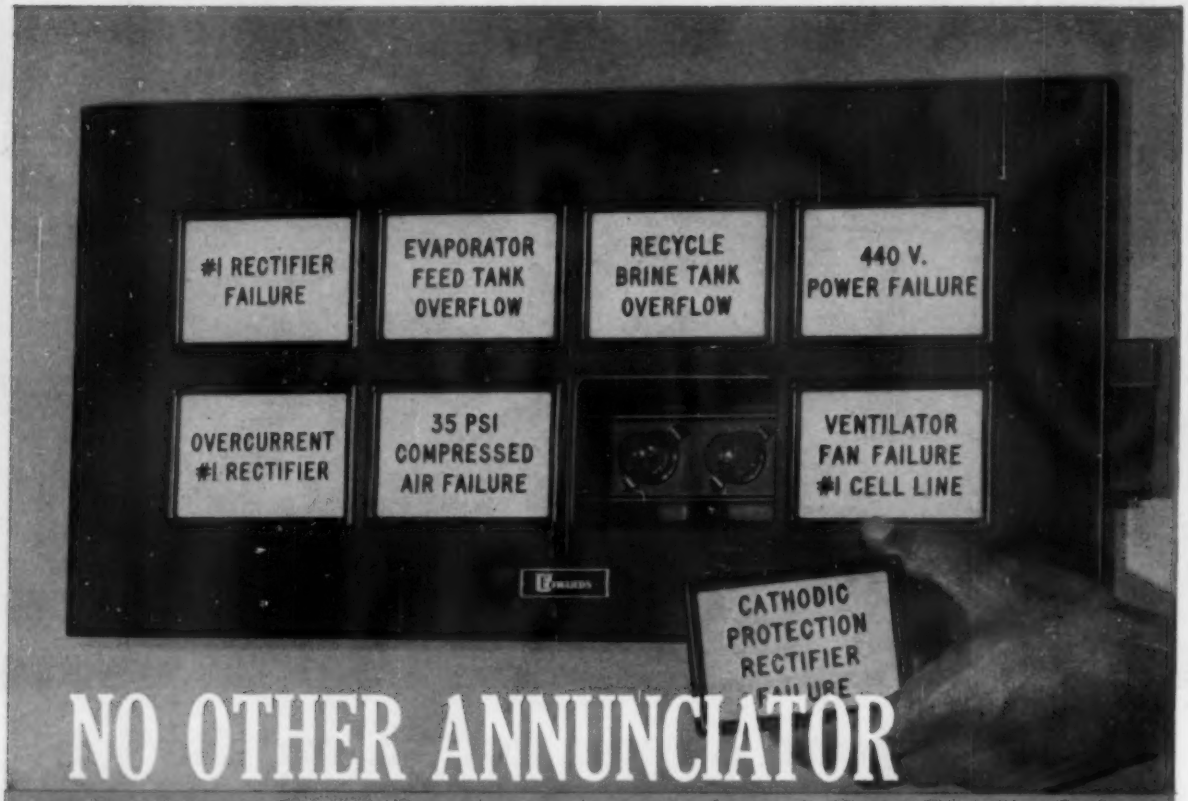
Address.....

City..... Zone..... State.....



☐ Impact Wrenches ☐ Hammers ☐ Belt Sanders ☐ Vacuum Cleaners

For more facts circle 611 on Reply Card


#1 RECTIFIER FAILURE
EVAPORATOR FEED TANK OVERFLOW
RECYCLE BRINE TANK OVERFLOW
440 V. POWER FAILURE
OVERCURRENT #1 RECTIFIER
35 PSI COMPRESSED AIR FAILURE
VENTILATOR FAN FAILURE #1 CELL LINE
CATHODIC PROTECTION RECTIFIER

NO OTHER ANNUNCIATOR CAN OFFER SO MANY FEATURES

Now from Edwards long experience in annunciator systems, comes a completely new line of lamp annunciators incorporating outstanding operational features . . . developed in cooperation with consulting engineers, leading power stations, chemical process and industrial plants. Design and operational flexibility is keyed to present and future demands of automatic process control and all types of automated systems. Edwards technical specialists in 58 cities across the country can show you how Edwards lamp annunciator systems can provide the most reliable flexible operation for every type of indication. Write for your copy of a new descriptive Bulletin A-200. Edwards Company, Inc., Norwalk, Conn.

NO OTHER ANNUNCIATOR OFFERS YOU ALL THESE FEATURES:

Operation: 1. Operational sequences may be changed without altering terminals, connectors or jumpers, even while power is on. 2. Operation from normally-open or normally-closed circuit contacts may be easily changed after installation by merely plugging in the designated relay unit. 3. No power drain—no "dropping resistors" to burn out or cause internal heating. 4. Wide selection of operational sequences. 5. Simple specific purpose "plug-in" circuits. 6. Indicating circuit provides extra contacts and independent terminals for data logging or other control functions. 7. Test for all indicating lamps on annunciator as standard equipment. **Design:** 1. Complete modular construction for flexibility of application. 2. One-piece molded lamp compartment and indicating plates snap into position. 3. Long-life under-voltage, double contact bayonet lamps will not loosen. 4. Relamping from front without opening door. 5. Lamps in multiple, no signal loss in burnout. 6. Dust resistant, continuous gasket front and back. 7. No exposed live parts. 8. Circuits plug in—vibration-proof lock. 9. No mounting holes required for panel mounting types. 10. Long-life relays—high temperature insulation, diffused gold contacts of higher rating, nylon coil, sealed windings. 11. Hermetically-sealed relays available when specified. 12. Heavy-duty barrier-type terminals accommodates through No. 10 AWG wire.

EDWARDS

SPECIALISTS IN SIGNALING SINCE 1872/FOR CONTROL • COMMUNICATION • PROTECTION/IN CANADA: EDWARDS OF CANADA LTD., OWEN SOUND, ONT.

For more facts circle 612 on Reply Card

For more facts circle 611 on Reply Card

PLANT ENGINEERING EQUIPMENT

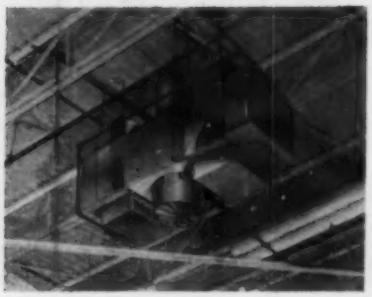
(Begins on page 214)

force to hold the air valve position despite severe vibration. Model 752 features construction materials designed to resist corrosion, has an explosion-proof/vapor-proof switch housing. Twelve float chambers are available. Magnetrol, Inc.

▲ For details, circle 25 on Post Card

UNIT HEATERS, gas fired vertical discharge type

For installation at heights up to 36 ft, IGV Heaters deliver large volumes of air at high velocities and comfortable final air temperatures to heat working areas, even when installed above



craneways and other plant equipment, it is announced. In spite of their relatively high heating capacities—300,000; 450,000; 600,000 Btu/hr input—the units weigh only 383 to 680 lb, normally permitting suspension directly from existing structural members of the building. Motors range from ½ to 1 hp, minimizing power and wiring requirements. Burners are stainless steel and heat exchangers are stainless or aluminized steel. Bulletin IGV-660 gives further information. Modine Mfg. Co.

▲ For details, circle 26 on Post Card

PORCELAIN CHECK VALVES have broad application

These valves incorporate a flanged porcelain body, a guided porcelain cone or aluminum ball check, and a Teflon seat. According to manufacturer, they can handle hydrochloric acid, metal salts, dilute compounds, and other active corrodants destructive to most metals and special alloys. The solid porcelain body is claimed to be unaffected by acids except hydrofluoric and hot concentrated phosphoric, and to be relatively resistant to alkalies. Recommended by manufacturer for up to 150 psig pressure, the assemblies may be modified for

NOELTING Faultless Casters

L900

DOUBLE BALL BEARING SWIVEL
MEDIUM DUTY

CUT YOUR HANDLING COSTS 3 WAYS

Faultless Casters

SUPERIOR DESIGN FEATURES

1. CORRUGATED TOP PLATE . . . fully hardened to give added strength. Slotted mounting hole spacing permits easy attachment.
2. MAIN LOAD BEARING . . . consists of 21 hardened, polished balls (⅜" dia.) rolling in large dia. hardened, lubricated raceway permanently attached to caster horn to assure perfect alignment.
3. LOWER THRUST BEARING . . . contains 10 hardened steel balls (⅝" dia.). Hardened raceway is machined from bar stock. Ball retainer is hardened formed steel.
4. EXTRA-LARGE DIAMETER KINGPIN . . . assures bonus strength in this caster.
5. CLOSE FITTING, FORMED STEEL CUP . . . protects thrust bearing from foreign matter. Holds lubricants in bearings, keeps floor clean.
6. HEAVY GAUGE, FORMED STEEL HORN . . . easily absorbs highest rated loads and thrust.
7. FULL SELECTION OF WHEELS . . . for all types of floors and operating conditions. Bolt and nut axles permit quick wheel replacement when needed.

SERIES L9700 RIGID PLATE CASTER
Wheel types and sizes, load capacities and overall heights to match L900 Swivel Plate Caster.

ASK YOUR DISTRIBUTOR! Your Faultless Industrial Distributor will be glad to serve as your expert on casters and wheels. He stocks Faultless Casters and is prepared to offer "plus value" by recommending the right type, load capacity and wheels to suit your requirements. He is listed in your phone directory under "Casters."

FREE! SEND FOR ILLUSTRATED LITERATURE

Faultless Caster Corporation
Evansville 7, Indiana

Send me Free L900 Medium Duty Caster information.

Name_____

Firm_____

Address_____

City_____ State_____

For more facts circle 613 on Reply Card

Resolite C-R

Installed in Pickling Enclosure at major steel company

A large steel producer recently completed rebuilding this pickling plant, located within a building housing their Hot Strip Finishing Department. Only sheets are pickled here, being dipped in two successive tanks containing a sulphuric acid solution, then in a clear water rinse tank.

■ A heavy vapor cloud rises off the tanks, hitting the roof during the pickling operation, and is then drawn off through an exhaust system. The presence of moisture and chemical contaminants creates in the enclosure an extremely high corrosion concentration.

■ After considerable testing, RESOLITE C-R Panels were installed in the roof, as well as formed into special shapes, to enclose the exposed steel overhead beams. A special formulation of resins used in the manufacture of RESOLITE C-R offers a material that has excellent chemical corrosion resistant qualities.

■ For further information why not send for our booklet on RESOLITE C-R.

Engineering specialists in Reinforced Polyester Panels

Resolite Corporation
P. O. Box 539, Zelienople, Pa.
Distributors in Principal Cities

For more facts circle 614 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

spring loaded operation, and come in sizes from ½ to 3 in. Process Equipment Div., Lapp Insulator Co.
▲ For details, circle 27 on Post Card

PROXIMITY SWITCH features delayed relay action

When used with a proximity pickup, Model 4906-JIC Proximity Control is designed to provide a versatile, economical means of automating a variety of industrial processes. Proximity pickup, mounted at point of work, senses ferrous and non-ferrous metal

parts. Two types of delay are provided: a slow-make, quick-break, where metal can be in presence of pickup for given amount of time before relay is energized, and relay is immediately de-energized after metal leaves field; and a quick-make, slow-break type where relay is immediately energized after pickup is activated by metal and remains activated for entire time metal is near pickup and for a pre-set delay or hold-time. The slow-make, quick-break feature is suggested for control of automatic parts feeders, and the quick-make, slow-break for control of fast-moving parts. Bulletin EDPS-80 gives data. Electro Products Laboratories, Inc.
▲ For details, circle 28 on Post Card

CENTRIFUGAL PUMPS are NEMA-matched with motors

Adapt-Able Centrifugal Pumps, designed to furnish a wider range of clear water, non-clog and other liquid modifications, are NEMA-matched; that is, pump dimensions align with those of NEMA-rated motors for ease of mounting and efficient operation. They are constructed so that pump frames receive various size volutes and impellers. Design permits most economical frame sizes to be

SWARTWOUT FIBER-AIRE

Combines All The Features We've Ever Been Asked To Put Into A Ventilator . . . At No Premium In Cost!

With Fiberglas* Housing . . . Stainless Steel Wheel

Quiet enough for the president's office yet rugged enough for the toughest plant conditions.

Indestructible — tough, resilient Fiberglas housing is virtually impossible to dent, crack or break . . . impervious to most chemicals, weather, salt spray.

Low initial cost — in spite of its many exclusive features and highest quality materials and construction, Fiber-Aire costs less than many other ventilators with fewer advantages.

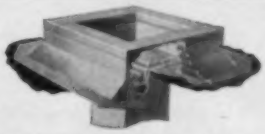
Low operating cost — new design stainless steel air flow guides plus low turbulence throat and outlet give 20% to 50% greater efficiency than most radial discharge centrifugal ventilators.

Low maintenance cost — molded-in color never needs painting . . . Fiberglas insulates motor to run cooler, longer . . . housing can't rust or corrode.

Super-quiet — low turbulence design cuts noise generation . . . all Fiberglas housing actually absorbs noise and vibration.

"Invisible" color — molded-in SX-100 sky-blue color makes Fiber-Aire almost impossible to see against the sky . . . actually becomes more blue on bright days and grayer on dull days. Leaves roof lines clean and attractive.

Available in Direct Drive and Belt Drive Centrifugal and Direct Drive Axial Models . . . 180 to 13,150 C.F.M.



Optional Prefabricated Curb

Swartwout "Insta-Curb" speeds installation . . . assures correct mounting . . . provides long-lasting, low-cost, custom-made curb for Fiber-Aire units.

Free engineering service plus complete information on Swartwout's full line of power and gravity ventilators available on request. Write or call today.

* TM — Owens Corning Fiberglas Corporation

Swartwout **SWARTWOUT**
Fabricators, Inc.

Kokomo, Indiana

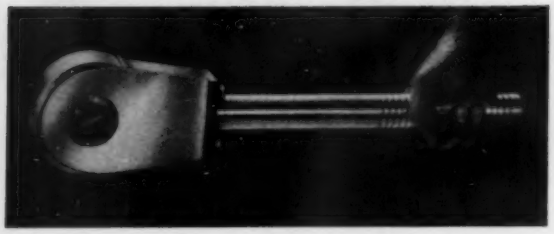
In Canada: Eastern Steel Products, Ltd., 8 Bermondsey Rd., Toronto, Ont.

For more facts circle 615 on Reply Card

designed to solve a universal maintenance problem

MANUAL IMPACT WRENCH—
loosens the tough nuts
power wrenches can't budge!

SWENCH®



Model 750—for bolts ½" to 1¼" • Model 1000—for bolts ¾" to 1¾"
Model 1500—for bolts 1¼" to 2½"

- **Loosens "frozen" nuts in seconds**
- **Tightens nuts to maximum practical tightness**

SWENCH is an entirely new concept in wrench design. It is the world's *only manual impact wrench.*

NEW SPEED—Nuts that previously had to be burned off can now be "SWENCHED off"—with unbelievable ease—by *one* man—in a matter of minutes.

NEW EASE—Only SWENCH in its torque class is truly portable . . . lets you take the wrench to the job—*anywhere*—with no auxiliary equipment, no power connections.

NEW SAFETY—With SWENCH there's no back-breaking, knuckle-knocking struggle . . . no dangerous handle extensions . . . no sudden release of a frozen nut . . . no shock transmitted through the handle.

NEW POWER—SWENCH, size for size, gives greater—and more effective—torque than power wrenches . . . multiplies torque applied to handle over 1500% (yet all SWENCH's power is built into the wrench itself).

NEW ECONOMY—SWENCH saves in *many* ways . . . no auxiliary equipment to maintain and man, no costly upkeep on the wrench, no man-hours fighting frozen nuts—*and* SWENCH costs less than half as much as wrenches with comparable impact power.

NEW VERSATILITY—*One* SWENCH can handle more bolt sizes than any power wrench . . . loosening or tightening requires no special adjustments.

NEW TENSIONING ACCURACY—Precise tightening is assured with SWENCH, following simple instructions.

Write for further information and a quick and convincing demonstration.

"When you're up against the tough nuts . . .
Don't wrench it . . . SWENCH it!"

MARQUETTE DIVISION

CURTISS WRIGHT

CORPORATION • GALEWOOD DRIVE, CLEVELAND 10, OHIO

For more facts circle 616 on Reply Card

PLANT ENGINEERING EQUIPMENT

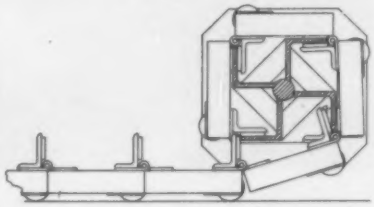
(Begins on page 214)

selected to match motor horsepower requirements of pumping job. Adapt-Ables are available in horizontal and vertical pump and motor units as well as "biltogether" construction. Fairbanks, Morse & Co.

▲ For details, circle 29 on Post Card

FOLDING COLUMN transmits loads, stores compactly

This power-operated folding column rolls in or out to form a rigid column capable of pushing or pulling heavy loads linearly with a steady force. The unit needs no attachments and when rolled in it occupies only a small percentage of its extended size. For example, one of standard units extends 45 ft, but is taken up into a space only about 2 ft square. As shown in the



sketch, column is formed of hinged links of steel or other channel wound helically around a power operated drum. The drum, formed of angle-shaped structural members resembles (in cross section) a swastika on a stick. When equipped with a powering device, the drum feeds out or withdraws the column to transmit large forces. As it unrolls, the column is rigid in three directions; however it must roll out over a flat surface to provide rigidity in the fourth. In addition to standard models, custom sizes and capacities can be ordered in materials to meet corrosion, weight and other requirements. Wayne Iron Works.

▲ For details, circle 30 on Post Card

PROTECTIVE GLOVE is sensitive, pliable and tough

Newest in this company's Neo-Sol line of gloves is the Sensi-Touch—milled Neoprene with satin interior finish. It is designed to give the wearer a feeling of sensitive flexibility and comfort heretofore not found in Neoprene protective gloves and to offer advantages not available in latex gloves. A feature announced is absence of free sulfur or salts, the presence of

9:30 P.M.

Everything's under Control!

There's also an *unseen* maintenance worker on the job tonight. Robertshaw's unique Vibraswitch is monitoring malfunction on 24-hr. operating equipment... guarding costly air compressors and blower systems against the hazardous and expensive dangers of extensive breakdown. Everything's under control! Vibraswitch is the proven low-cost way to directly sense destructive vibratory forces in expensive rotating and reciprocating machinery. Instant reaction to changes in acceleration of machinery vibration with shut down, alarm and standby-actuation provisions. Should your expensive machinery break down, how costly will repairs be? Can you afford to be without low-cost Vibraswitch protection? In malfunction detection, level measurement or accurate handling of process ingredients, Robertshaw has a system for keeping "everything under control." Fifty convenient offices—write for name of the one nearest you.

ROBERTSHAW'S VIBRASWITCH
MALFUNCTION DETECTOR
IS ON THE JOB!

Aeronautical and Instrument Division, Robertshaw-Fulton Controls Company, Santa Ana Freeway at Euclid Avenue, Anaheim, California

Robertshaw

MANUFACTURERS OF ROBERTSHAW CAPACITANCE-ACTUATED LEVEL MEASUREMENT INSTRUMENTS AND MICROSEN INDUSTRIAL PROCESS CONTROL SYSTEMS

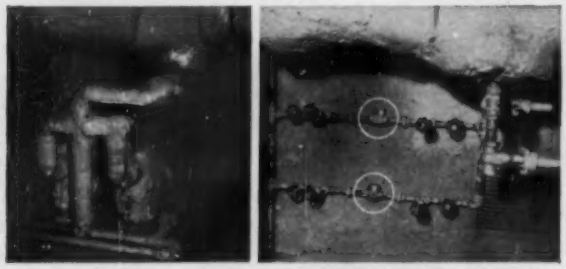
For more facts circle 617 on Reply Card

SARCO TOPICS

How Major New York office building solved steam trapping problems through trap standardization

Recently, the Office Building at 625 Madison Avenue, New York, — erected in 1931 and comprising 420,000 square feet on 17 floors — discontinued its own steam generation and switched to district steam. The change-over made the inadequacies of old bucket and float traps more apparent than ever, and afforded an occasion to modernize trapping. Here's how major improvements were made.

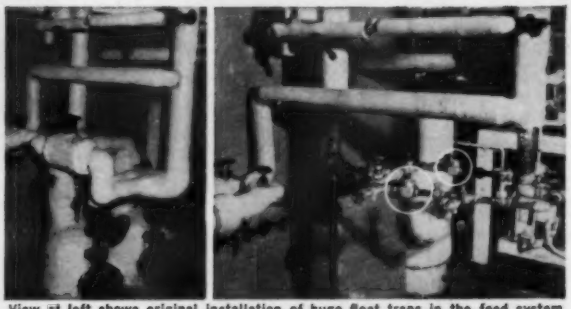
The first problem was maintenance. All maintenance had to be done at night or on weekends, at overtime rates, because the system could not be shut down during business hours. Frequent breakdowns added to maintenance costs. After the installation of Sarco Thermo-Dynamic Steam Traps, Type TD-50, trap maintenance — and therefore maintenance costs — have been reduced almost to zero. The engine room crew are now free for other jobs, and savings in both regular and overtime manhours are considerable.



Left picture shows the steam service main from the street, with massive float trap installation. Picture at the right is view of installation after the change-over to TD-50's (circled).

The second problem was water-hammer, caused by passage of live steam into return lines when traps failed open. (When traps failed closed, water accumulated in steam supply mains and equipment.) Installation of TD-50 steam traps ended waterhammer and consequent damage to equipment, because the TD-50 discharges condensate as rapidly as it is formed and prevents steam from entering the return system.

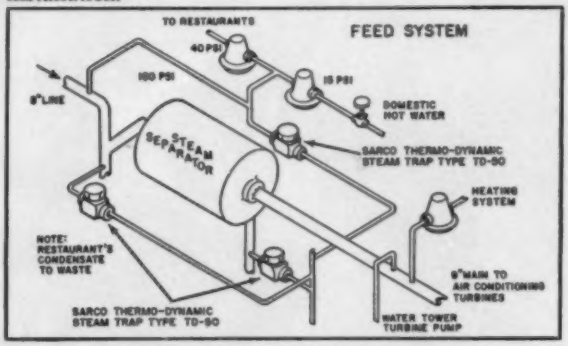
The third problem was live steam loss. Live steam, discharged into the return lines, not only represented a great waste of heat energy, but caused waterhammer in the return, and raised the condensate temperature to an excessive level. (Incidentally, although the building's district steam system is, of course, not faced with this problem, hot condensate passing through condensate pumps can damage pump seals.) These problems are eliminated through the use of TD-50's. No steam can be blown into the return main because the TD-50 shuts off *positively*, blocking any possibility of live steam being discharged into the return. Savings are considerable.



View at left shows original installation of huge float traps in the feed system of the building. View at the right shows compact installation of Sarco TD-50 Steam Traps (circled).

These benefits were achieved by replacing bucket and float traps with Sarco Thermo-Dynamic Steam Traps, Type TD-50, matched and correctly sized to the application. For example, many ½" bucket traps were replaced with ⅜" TD-50's, which have ample capacity for the job.

The TD-50's pressure range of 10-600 psi made it possible to standardize on one steam trap for a variety of applications that formerly required traps of many different types and pressure ratings. Finally, changeover took only 30 minutes per trap for each compact TD-50 installation.



Schematic hook-up of the converted feed system.

The success of this TD-50 installation led Collins, Tuttle Co., Inc., managers of the building, to substitute Sarco Thermo-Dynamic Steam Traps for competitive bucket traps in two other major New York buildings.

For more information on Sarco Thermo-Dynamic Steam Traps, contact your Sarco Sales Representative or district office, or write.

2165

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE NEW YORK 22, N. Y.
PLANT BETHLEHEM, PA.

STEAM TRAPS • TEMPERATURE CONTROLLERS
STRAINERS • HEATING SPECIALTIES

For more facts circle 618 on Reply Card

SARCO

Here are 7 Sound Reasons Why the Thermo-Dynamic® Does a Better Job of Trapping

1. *Simplicity*—has only one moving part. 2. *Maintenance*—practically zero. 3. *Wide pressure range*—one trap for all pressures from 10 to 600 psi. 4. *Uniform performance*—operates equally well on heavy, light, or no condensate load. 5. *Operates against back pressures*—up to 50% of inlet pressure. 6. *Rugged*—unaffected by superheat, water hammer, vibration, or corrosive condensate. 7. *Minimizes inventory* of spare parts.

Maintenance Time: 40 Seconds. If it now takes your maintenance crew more than a couple of minutes to service an ordinary trap, you're throwing away valuable time. This Sarco Thermo-Dynamic can be cleaned, blown out if necessary, and reassembled on the line in as little as 40 seconds.

For Prompt Information on the TD-50 . . . or for fast help on the efficient solution of any steam trapping problems, get in touch with a SARCO District Office, Sales Representative, or Distributor. (There's one near you.)

Only SARCO makes all 5 types:

Thermo-Dynamic* • Thermostatic • Liquid Expansion • Float Thermostatic • Inverted Bucket

*U.S. Pat. No. 2,817,353 TM Reg. U.S. Pat. Off. 1409

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

which could damage fine instruments or parts. The gloves are 10½ in. long, have a single wall measurement of 0.007 to 0.010 in. for standard exterior finish; 0.010 to 0.012 in. for non-slip hand finish. They come in hand sizes from 7 to 11. Brochure Ind.-60-1 gives data on the Sensi-Touch. Charleston Rubber Co.

▲ For a copy circle 31 on Post Card

STEEL GRATING UNIT for floors, treads, ramps

Recent addition to the Dexion system of slotted angle construction is Open Steel Plank, a standard unit for combining with Dexion angles to provide

load-bearing floors, ramps, catwalks, stair-treads, mezzanines and platforms. Available in lengths of 4 ft, 6 in. or 6 ft, each unit is 9 in. wide, pressed from a single slab of 16-gage mild steel. A single-bolt fixing plate makes assembly fast and simple. Finish is grey stove enamel over phosphated steel. Dexion Inc.

▲ For a copy circle 32 on Post Card

INTAKE UNITS replace air removed by exhaust systems

Vertical discharge air intake units—for use in replacing air removed by exhaust systems—have a capacity range of 4,000 to 36,000 cfm. Key to versatility of the line is the assembly to meet job requirements of standard components. Shutters, steam coil, filter house and outlet diffusers are added as needed to the basic low silhouette, black-out type roof ventilator fan housing. Where tempered air is required and a steam coil used, Btu capacity (at 5 lb steam pressure) ranges from 380,000 to 2,642,000 Btu/hr. Hartzell Propeller Fan Co.

▲ For a copy circle 33 on Post Card

FIXTURES, surface mounted, have perforated frames

Perforated door frames provide a modicum of light on the sides of fixtures, improving appearance, company says. The door frames, designed to hold glass lenses or aluminum louvers, will be supplied with company's Type-SF fluorescent luminaires. Fixtures accommodate two, three or four lamps having lengths of 4 or 8 ft and ratings of 40 or 75 w per lamp. They can be mounted as individual units or adjacent to each other for continuous lines of light. Westinghouse Electric Corp.

▲ For a copy circle 34 on Post Card

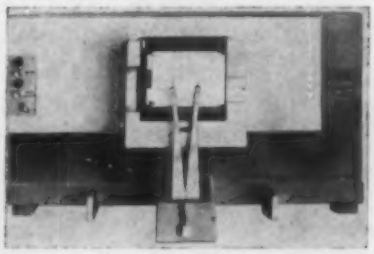
HEAVY DUTY DRILL with improved keyless chuck

According to manufacturer, this ¼-in. drill, Model 355, features a keyless chuck so accurate it can hold a human hair in its center—and it allows bits to be changed in seconds with a twist of the fingers. The drill is a heavy-duty, ball bearing model suggested for ductwork and aircraft sheet metal, as well as for wood drilling. Porter-Cable Machine Co.

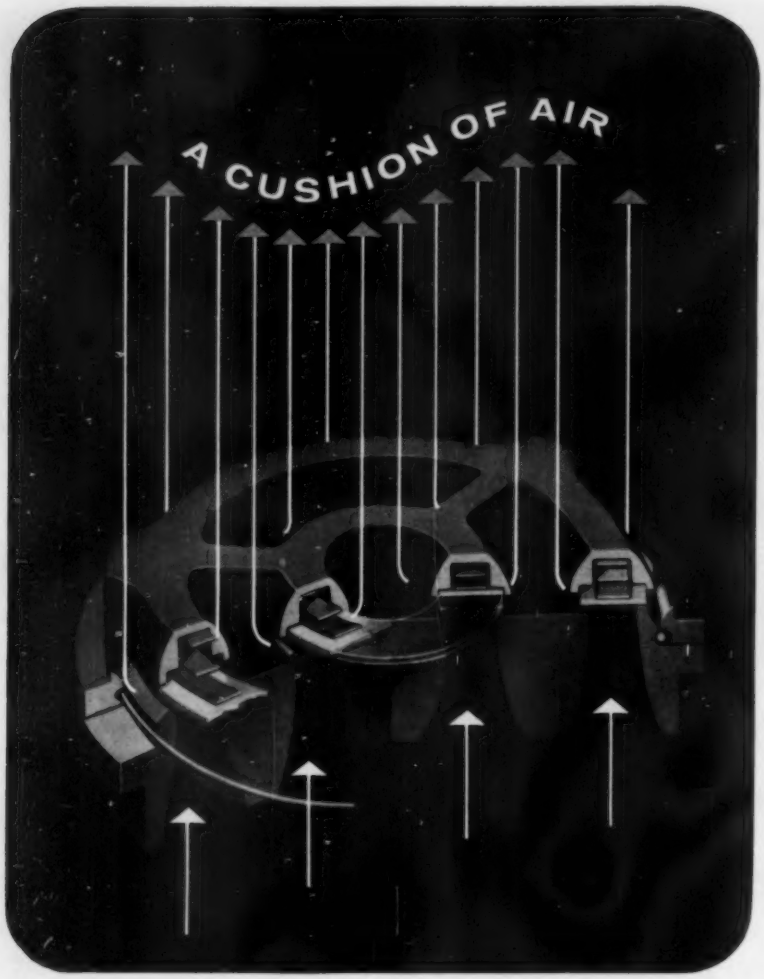
▲ For a copy circle 35 on Post Card

CHART INTEGRATOR gives three values from one run

This integrator not only computes the chart extension for differential and static pressure, but also provides read-out values for average absolute static pressure and average differ-



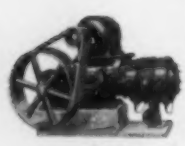
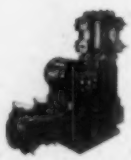
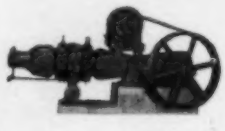
ential pressure. It handles company's own strip charts and conventional round charts by means of an adapter plate supplied with the instruments. According to manufacturer, the integrator was developed for greater



makes PENNSYLVANIA COMPRESSORS run efficiently...silently...with minimum maintenance. Stainless steel valve discs lift against a cushion of air in the simple, efficient design of the Air Cushion Valve that makes PENNSYLVANIA Compressors run so silently, so dependably, and with such low maintenance requirements. Air Cushion Valves have no nuts, bolts, or screws to break or burn fast. You get longer valve life . . . eliminate wear . . . eliminate noise caused by metal striking metal. Flat valve discs have no flexing or bending action to weaken or distort them; they remain perfectly flat and tightly seated over long periods of service.

But this is only part of the PENNSYLVANIA story. Learn all the facts in "Compressors For Industry." It describes PENNSYLVANIA Compressors from 10 to 350 hp, horizontal, angle, and OILFRE models. Write to Dept. B-10 for your copy today.

PENNSYLVANIA
PUMP AND COMPRESSOR COMPANY
Easton, Pa. • Earning Customer Confidence Since 1920

For more facts circle 619 on Reply Card

PLANT ENGINEERING EQUIPMENT

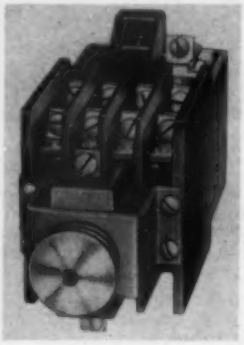
(Begins on page 214)

efficiency in chart interpretation and for ease of operation with reduced eye strain. Records are easy to check as follower pens superimpose a light ink line on the original chart record. American Meter Co.

▲ For details, circle 36 on Post Card

CONTROL RELAY combines compactness, dependability

Known as the Compact 300, this relay is rated at 6 amp, 300 v maximum. It is a fixed circuit device with provisions for eight independent poles, and is also available in two, three, four or six poles in any combination of nor-



mally open or closed contacts. Specifically tailored to meet the demands of automation, company says it requires up to 70 per cent less panel space than other types. Use of bifurcated (split-saddle) contacts which provide four current paths assures electrical reliability. An electro-mechanical memory latch can be added at any time for greater flexibility in control circuitry, particularly when control is needed to match machine sequence. Cutler-Hammer, Inc.

▲ For details, circle 37 on Post Card

To receive product data circle item numbers on the handy Reader Service Cards provided on pages 301-302.

EPOXY COMPOUND for floor patching and surfacing

Para-Resin is an epoxy floor patching and surfacing compound said to provide a bond stronger than concrete, bonding permanently (without bonding agent) to dry or wet concrete,

NALCO'S OWN POPULATION BOOM...

(in Water Treatment Skills and Experience)

These are the Nalco people in the background* when a Nalco Representative tackles your water treatment problem. He can call on any or all of them when necessary ... and the specialized skills and experience they have are strong support for his own expert knowledge of water treatment chemicals—and how plants should use them.

Nalco's population boom in water treatment skills and experience is simply further assurance that when you want water treatment *results* your Nalco Representative is the man to call.

**The technically trained headquarters people who conduct research and customer service work on every kind of water treatment problem.*

Nalco CHEMICALS
Nalco SERVICES
Nalco CHEMICALS
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NALCO CHEMICAL COMPANY

6217 West 66th Place • Chicago 38, Illinois

Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany
In Canada: Alchem Limited, Burlington, Ontario

Nalco® ... Serving Industry through Practical Applied Science

For more facts circle 620 on Reply Card

DODGE PRODUCTS you should know

TORQUE-ARM
America's most widely used shaft mounted speed reducers!

FLEXIDYNE
The Dry Fluid Drive
New soft starts . . . overload protection!

TAPER-LOCK
CHAIN COUPLINGS
No reboring — no waiting!

●

Write for Bulletins!

- Torque-Arm — 55 models — data.
- Flexidyne Drives & Couplings.
- Chain Couplings and Sprockets.

DODGE MANUFACTURING CORPORATION
2700 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

wood, steel, mastic, or any other clean surface, even glass. It is described as waterproof and unaffected by vibration or temperature extremes, impervious to alkalis, oils, and greases and resistant to acids and solvents. Package contains precise amounts of aggregate, resins and pigment, for easy application by unskilled workers. Curing is through chemical action, and at room temperature; it cures enough for foot traffic in 4 hrs, and for heavy traffic in 24. Standard colors are light grey and red, with others available. Paramount Industrial Products Co.

▲ For details, circle 38 on Post Card

PRESSURE SWITCH in both bellows and piston types

The CR127 is introduced for pilot duty applications on pneumatic and hydraulic systems of process machinery, machine tools, welding equipment, and for pressure lubricating systems. It has one normally open and one normally closed, pilot duty contact-rated 15 amp carry on 110 v and 5 amp on 600 v a-c. A piston type for hydraulic applications, and a bellows type (shown) for ranges to 300 psi are available. The latter, designed primarily for machine tool applications, comes in six pressure ranges and operates from air, oil or water pressure. It has a 0.060 orifice

to prevent false operation due to minor pressure surges. The pressure setting is shown in cover window and can be externally adjusted.

The piston type pressure switch consists of a steel piston in a machined cylinder; it is used on hydraulics with pressure from 135 to 3000 psi. It has a 0.040 orifice to protect against minor pressure surges, and a range locking nut. An oil leakage outlet on the low pressure side of the piston is in the cylinder wall to provide an exit for any oil that leaks past the piston. This outlet is tapped to allow for a return line to the hydraulic reservoir.

Both forms have a switchette with snap-action contacts, which can be used as two circuits if the same voltage and polarity is applied. Optional features include surge reducers, neon pilot light to indicate pressure on or off. General Electric Co.

▲ For details, circle 39 on Post Card

PAGING SYSTEM speeds messages to personnel

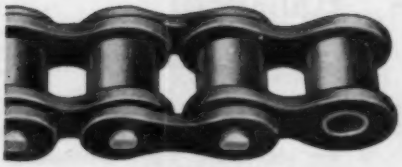
With the Tele-Tracer Wireless Paging System, the recipient of a message, carrying a receiver in his pocket, is selectively paged through a centrally located signal-sending station that accommodates from 9 to 360 receivers. A button corresponding to a particular

receiver is depressed at the sending station, activating a gentle buzz or blinking light at the selected receiver. By placing the receiver to his ear, the recipient can listen to the completely private verbal message. Receivers are powered by rechargeable miniature accumulators. At night the receiver is placed in a receptacle and automatically recharged. Cost for an average system is said to be around $0.08 per day per receiver. Standard Research Consultants, Inc.

▲ For details, circle 40 on Post Card

DRAIN TRAP with greater discharge capacity

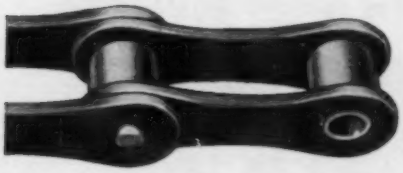
For use on compressed air lines to machines and air equipment, this small trap is designed to automatically discharge condensate and oil as it is collected. According to manufacturer, its larger size orifice has increased the discharge capacity by 350 per cent, permitting a discharge rate of 60 gph. A blow-off valve is provided for periodic removal of accumulated dust and residue. Orifice and valve seat are self cleaning. The trap is only 7



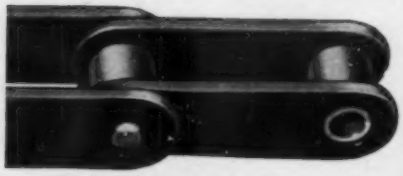
SINGLE STRAND

DOUBLE STRAND

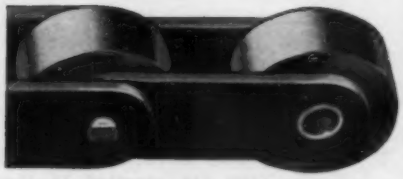
SINGLE STRAND, HEAVY SERIES



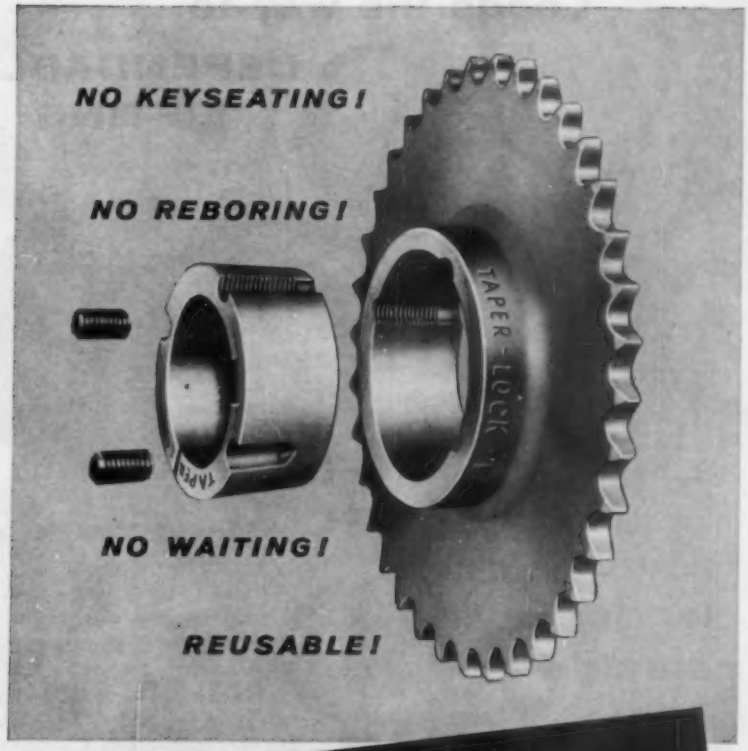
DOUBLE PITCH TRANSMISSION



DOUBLE PITCH CONVEYOR



DOUBLE PITCH CONVEYOR, LARGE ROLLERS



TAPER-LOCK SPROCKETS DODGE ROLLER CHAIN

DODGE Quality Roller Chain, teamed with Dodge Taper-Lock Sprockets, results in chain drives and chain conveyors that have the precision, efficiency and stamina necessary for the real economy of *long life*.

Moreover, Taper-Lock's reusable bushing makes a difference in overall cost. The ease of Taper-Lock mounting, the elimination of reboring, keyseating, and wasted time, add to the saving. Precision machining and true articulation lengthen the life of *both* sprocket and chain.

The Dodge line of chain, including standard attachments, is extensive. It meets a high percentage of all chain requirements.

In the Double Pitch series (both Transmission and Conveyor) the sizes which require special spacing for perfect tooth action are offered from stock in special double pitch design — to double the life of the chain and the sprocket!

Ask your local Dodge Distributor. Or write us for bulletin.

DODGE MANUFACTURING CORPORATION, 2700 Union St., Mishawaka, Ind.

CALL THE TRANSMISSIONEER—your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."

DODGE
of Mishawaka, Ind.

For more facts circle 622 on Reply Card

Leads the way to DEPENDABLE LIFTING

...quality leader in electric chain hoists

performance... the real test

Many thousands in all types of service demonstrate that you, too, can profit from more efficient Lodestar handling...at lower costs and increased productivity.

attractively priced...

Initial cost surprisingly low...operates for pennies per day...built to serve you without costly maintenance.

end your hoist problems...

Select Lodestar from a complete range of capacities and speeds...⅛ to 2 tons and 8 to 60 fpm. Interchangeable lug, hook and trolley suspensions.

Outstanding Lodestar® features include...

CONVENIENT PUSH BUTTON OPERATION—Precise and safe load control.

LOWEST HEADROOM—For highest lifting... unmatched by any other hoist of similar type.

HEAVY DUTY PERFORMANCE—Ruggedly constructed to withstand the heavy demands of severe service.

DEPENDABLE DUAL BRAKING—Instantaneous acting, self-adjusting magnetic brake, plus ultra-modern regenerative electric braking.

FLEXIBLE WELDED LINK CHAIN—Famous CM-ALLOY type flexes freely in all directions... permits angle lifting ... easily inspected... extremely long wearing.

MINIMUM MAINTENANCE—Introduces new standards of maintenance-free service.

Request catalog and name of local stocking distributor

CM HOISTS

CHISHOLM-MOORE HOIST DIVISION
Columbus McKinnon Corporation
FREMONT AVE., TONAWANDA, N.Y.
NEW YORK • CHICAGO • CLEVELAND
In Canada: McKinnon Columbus Chain Ltd., St. Catharines, Ont.

For more facts circle 623 on Reply Card

PLANT ENGINEERING EQUIPMENT

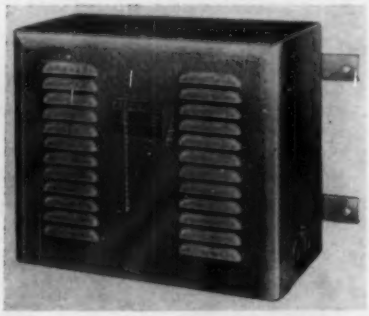
(Begins on page 214)

in. high, has an overall diameter of 4-⅝ in., weighs 2 lbs. Body and bowl are aluminum; valve mechanism is stainless steel and brass. Trap is available from stock in ¼ in. NPT. Bulletin 80 describes this trap. Perfecting Service Co.

For details, circle 41 on Post Card

MULTI-MOTOR CONVERTER for single-phase lines

Type MM Add-A-Phase Power Converter permits operation of three-phase electrical equipment from single phase lines, but with the additional feature of opening operation to any



number of three-phase motors through a single conversion system. Three-phase motors can be operated singly or simultaneously. Multi-motor transformer stations are available in sizes from 1 to 80 hp. Panel controls feature separate hp ratings to match each three-phase motor. Converter is designed to operate 220 or 440-v three-phase equipment from 220 single-phase lines. Add-A-Phase, Div., System Analyzer Corp.

For details, circle 42 on Post Card

ASBESTOS-CEMENT SHEETS pre-finished in colors

Decorative asbestos-cement sheets in pre-finished, permanently colored form are claimed to have a hard, smooth finish with about five times the life of most paints. The finish is applied in a dual-stage process which produces a washable, water-resistant coating, 3 mils thick. Fifteen colors are available, including white and black. Tests are reported to show these colors won't yellow or fade, and resist chalking. The color-finished sheets are as easy to fit as conventional asbestos-cement sheets, says manufacturer; they can be power drilled and sawed without cracking or

"But Crusher, everyone knows the **CLARK SHOCK ABSORBER DOOR** *can take it!*"

Won't rip, warp or come off the fastenings

The Bumper takes the Shock— Not the Door

Not just an improved Impact Door—but a totally different concept! The Shock Absorber Door keeps traffic moving without slow-downs or bottlenecks. No costly "time-outs" for repair.

Flexibly suspended, this lightweight door opens and closes freely, either manually or when pushed by a truck. Exclusive Urethane-filled Bumpers absorb shocks that would *wreck* ordinary doors. Spring Retriever returns door unfailingly to closed position. Neoprene sealing at all edges assures tight, draft-free closure. Keeps wanted air IN—unwanted air OUT.

Surprisingly low in cost, the Shock Absorber Door comes in one complete, easy-to-install unit. Needs virtually no maintenance. Proven in the plant. Learn why so many Blue Chip companies, after ordering one door, are now reordering several more. See our insert in Sweet's Catalog, or, better still, write us today for full information.

CLARK DOOR COMPANY, INC. *(since 1878)*

507 Hunterdon St. Newark 8, N. J.

For more facts circle 624 on Reply Card

Keep your
crews busy
all year 'round

with **CARBO ZINC 11***

the all-weather maintenance coating

Most maintenance paints cannot be applied below 40° F. Not so with Carbo Zinc 11 *. . . the only protective coating that can be applied outdoors in cold weather.* Paint *anytime*, 12 months of the year, indoors or out . . . keeping a *smaller* crew busy full time. You still get protection far superior to standard maintenance paints.

- a zinc-filled inorganic protective coating
- water insoluble 20 minutes after applying
- fast drying, long-lasting galvanic protection for steel
- apply in humidity up to 95%, temperatures from –20° F. to 150° F.
- excellent resistance to water, coastal environment, brine, humidity, solvents

Use Carbo Zinc 11 without topcoat, or as primer with vinyl, Hypalon, epoxy, or inorganic topcoat. Resists undercutting and subfilm corrosion. Low material, application and maintenance costs.

Write for information, technical data, uses and samples. Also, see our catalog in CEC, pages 911-914.

6011 *Patent applied for

carboline COMPANY

32-T Hanley Industrial Ct. St. Louis 17, Mo.

Sales engineers in principal cities. Consult your telephone directory.

MAINTENANCE COATINGS WITH EXPERIENCE

For more facts circle 625 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

chipping the colored surface. It is also noted that the finishes are not stained by mineral oils, grease, animal fats and are not affected by many chemical compounds. The color finish does not lessen the inherently non-combustible character of asbestos cement sheets because the coatings are self-extinguishing in nature. All of the ribbed and corrugated and most of the flat styles of asbestos-cement sheets produced by manufacturer are available with the colored finish. Keasbey & Mattison Co.

▲ For details, circle 43 on Post Card

PA SYSTEM is portable and includes lectern

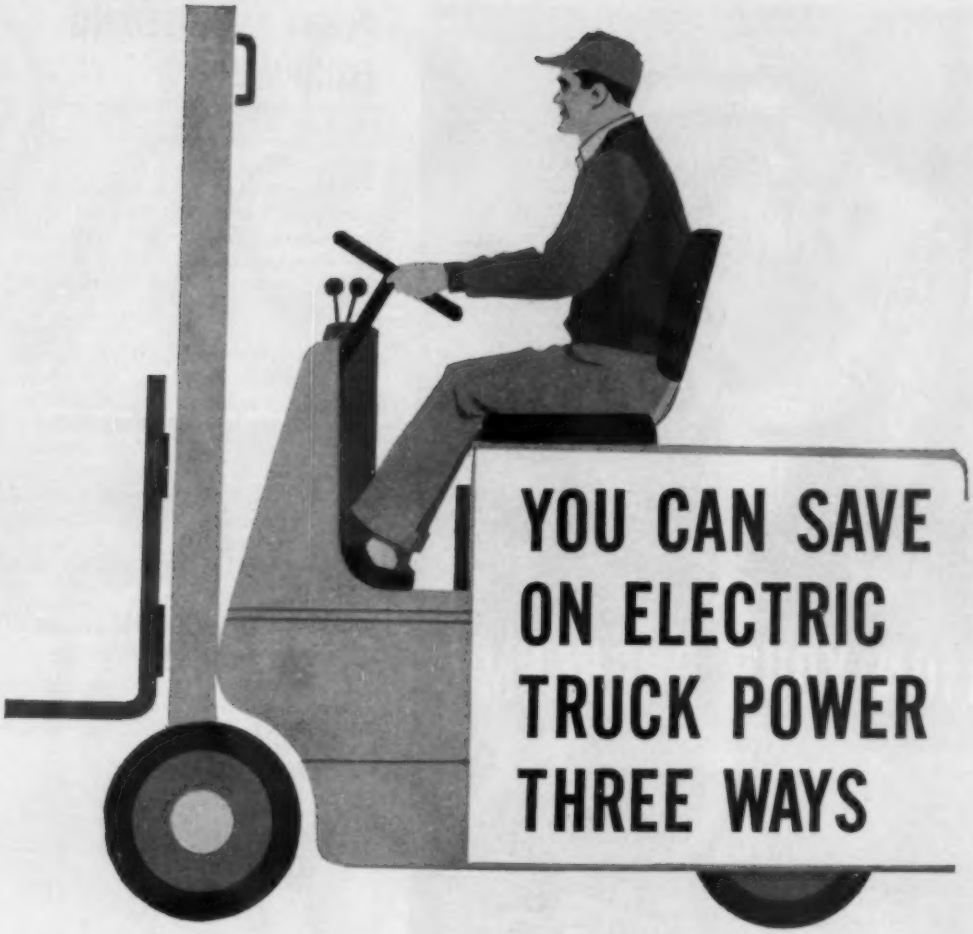
KX Roving Rostrum is transistorized and battery operated. This self-contained PA system is enclosed in a lightweight luggage-type carrying case and includes a microphone (with gooseneck stand), 10 w amplifier, 10-

in. heavy duty speaker, output for external speaker (when addressing crowds over 600) output for tape recorder, and phono/microphone inputs. The sealed speaker enclosure is said to assure minimum feedback and good tonal quality. The system runs on two lantern batteries having an average life of 3 mo. The unit is 16 in. high, 18 in. wide, 8½ in. deep and costs around $150 without batteries. Kinematix, Inc.

▲ For details, circle 44 on Post Card

ROOF VENTS with appearance, functional features

Power roof ventilators in the Horizon Line are available with a choice of three interchangeable discharges: standard straight-through, decorative straight-through, and mushroom. Low silhouettes and attractive styling are



YOU CAN SAVE ON ELECTRIC TRUCK POWER THREE WAYS

1 **Get more battery capacity per dollar per year.** For years, Exide-Ironclad Battery users have consistently reported unequaled battery economy. Now the new TGS Exide-Ironclad Battery gives you another 11% more capacity with no increase in battery size. Your trucks can do still more work per shift, and you get greater economy than ever.

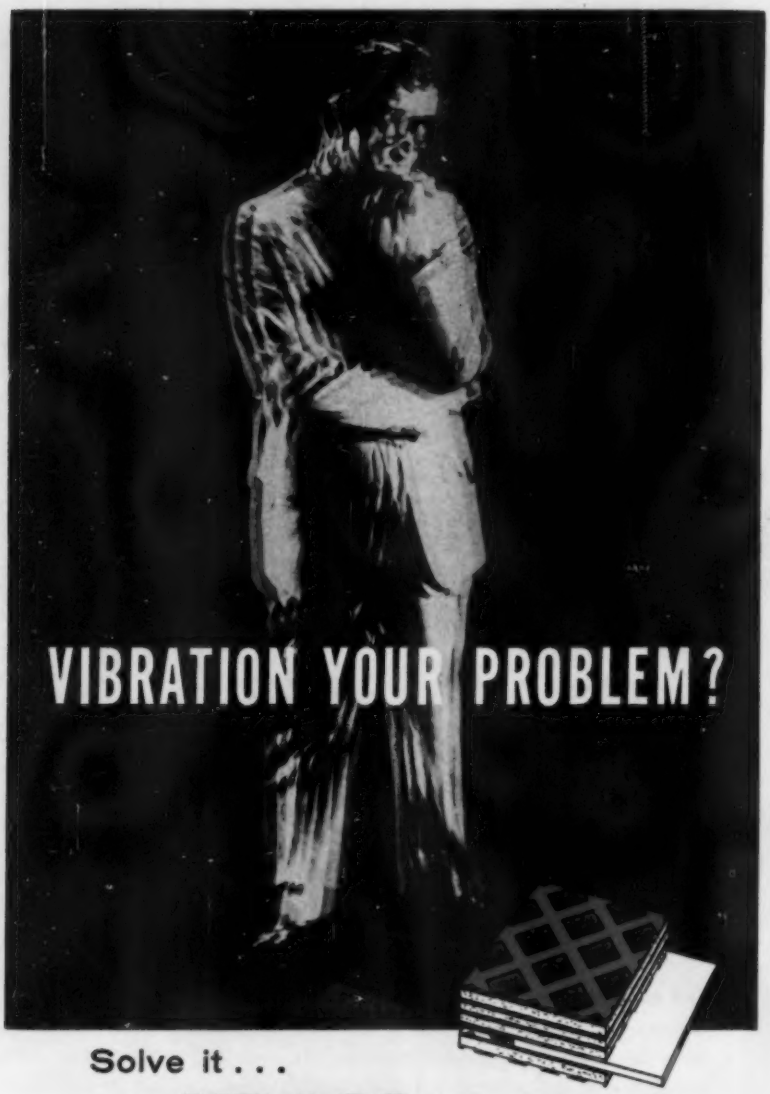
2 **Use efficient chargers.** Exide vertical chargers are specially designed for industrial truck service. They give you actually more charging capacity for the price. Vertical design saves two-thirds floor space, keeps out dirt for lower-cost upkeep. Oversize bearings, dual-protected by bearing seals and external dust shields, prolong charger life.

3 **Keep your equipment functioning.** Regular inspection by capable service men is a real economy measure. And no service matches Exide service—over 160 men in 47 offices coast to coast. All are factory trained—specialize in Exide industrial batteries and chargers. They help you get the maximum life and economy from your batteries.

GET THE COMPLETE EXIDE POWER PACKAGE: BATTERIES, CHARGERS, SERVICE. For additional information, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

For more facts circle 626 on Reply Card



Solve it . . .

with **AIR-LOC** Mounting Pads

For isolating and dampening vibration, Air-Loc is the answer. In actual production tests, it successfully reduces vibration up to 85%. Air-Loc is easy to install in a matter of minutes. It can be quickly shimmed for leveling, gives permanent machine alignment . . . and is re-usable.

The scientific cross-grid embossing of Air-Loc machinery pads literally anchors your machines to the floor . . . without cement, without bolts.

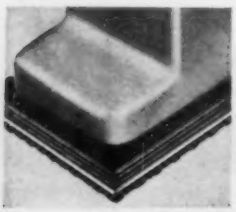
Air-Loc is made of three materials, and each plays its part in giving you the ultimate in easy, yet positive machine mounting:

Cork — absorbs vibrations, shock and noise. The cork used in Air-Loc is specially processed, under patents, to bring out its best physical properties.

Sisal Fibre — selected long-fibred sisal adds strength and stability.

Vinyl — completely surrounds the cork and sisal to give exceptional durability and permanent resistance to oils, alkalies and acids.

Write today for full information and sample.



Air-Loc® DIVISION

Clark, Cutler, McDermott Co.

115 WEST CENTRAL ST. • FRANKLIN, MASS.

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

complemented by a new color scheme: discharges are painted blue for unobtrusiveness against the sky, while bases are a neutral sand grey. Other features include a combination of magnetic damper lock, damper design, and rubber seal to make the units chatter- and leak-proof and light-tight. Motors are direct-connected to fan shaft. Discharge sections are hinge-connected to fan housing for accessibility. Ten fan and 12 motor sizes cover capacities from 600 to 51,000 cfm. Standard construction is welded heavy-gage steel with aluminum dampers. L. J. Wing Mfg. Co.

▲ For details, circle 45 on Post Card

FLUORESCENT LIGHT for localized industrial lighting

The Miniature Fluorescent Localite offers rugged construction for lighting small tools, assembly lines, repair

benches, and similar localized lighting areas. It can be set by hand in any position, yet will not budge under jarring or vibration, company says. Available in a variety of arm lengths, it will accommodate two T 5 8 w lamps and can be mounted vertically or horizontally. Fostoria Corp.

▲ For details, circle 46 on Post Card

BREAKERS offer broad protection with fewer frame sizes

This line of thermal-magnetic circuit breakers offers overload protection for the entire range of industrial applications with only six frame sizes instead of twelve, according to company. Also, they need less space for installation. Several frame sizes of the old line have been replaced with a fewer number of newly designed frames having a wide range of ratings. Frame sizes are designated E, FA, JA, KA, LA,

For more facts circle 627 on Reply Card

For more facts circle 628 on Reply Card →

GENERAL ELECTRIC

now!

Tri-Clad '55' motors with THERMO-TECTOR system

WARRANTED

against burnout from overheating

For the *first time* General Electric offers you a motor with such *positive* protection it is WARRANTED in writing against overheating burnout!
G.E.'s exclusive new THERMO-TECTOR system gives Tri-Clad '55' motors truly *inherent* over-temperature protection. Unique variable shut-off feature allows motor to deliver *full power potential* under all operating conditions. Fail-safe THERMO-TECTOR system has simple, two-lead hookup.

*Trade-mark of General Electric Co.

For the first time General Electric offers you a motor with such *positive protection* it is WARRANTED against *overheating burnout*

TURN PAGE FOR FURTHER INFORMATION

NOW - A Motor *Warranted in Writing* Against Overload Burnout!

General Electric Company warrants to the Purchaser that the Tri-Clad '55' motor with Thermo-Tector system delivered hereunder will:

(a) Not burn out because of overheating resulting from overload, lack of ventilation, single-phasing, stall, high ambient, or voltage unbalance, as long as the Thermo-Tector switches are connected into the control circuit so that power to the motor is removed when an over-temperature condition occurs;

(b) Be free from defects in material, workmanship and title; and

(c) Be of the kind and quality designated or described in the contract.

The foregoing warranty is exclusive and in lieu of all other warranties whether written, oral, or implied (including any warranty of merchantability or fitness for purpose). If it appears within one year from the date of shipment by General Electric Company that the equipment delivered hereunder does not meet the warranties specified above and the Purchaser notifies the General Electric Company promptly, the General Electric Company shall thereupon correct any defect, including non-conformance with the specifications, at its option, either by repairing any defective part or parts or by making available at the General Electric Company's plant, a repaired or replacement part.

The liability of the General Electric Company to the Purchaser (except as to title) arising out of the supplying of the said equipment, or its use, whether on warranty, contract or negligence, shall not in any case exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of said one year, all such liability shall terminate. The foregoing shall constitute the sole remedy of the Purchaser and the sole liability of the General Electric Company.

General Electric's *exclusive* THERMO-TECTOR system is available now on *all* Tri-Clad® '55' motors in frames 254U-445U. Contact your General Electric Apparatus Sales Office or Authorized Distributor *today* for details on this NEW FULLY WARRANTED MOTOR PROTECTION SYSTEM. Or, write for Bulletin GEA-7092, Section 866-04, Schenectady 5, N. Y.

SMALL AC MOTOR & GENERATOR DEPARTMENT

GENERAL ELECTRIC

PLANT ENGINEERING EQUIPMENT

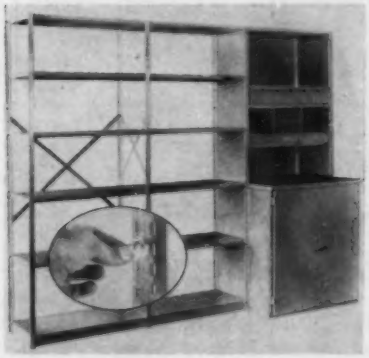
(Begins on page 214)

MA, with maximum current ratings from 10 to 800 amp, interrupting capacities from 5000 to 50,000 amp. Type KA breaker can be used instead of the old JK and K frames, it is explained, but it is only 5½ in. wide and 10⅛ in. long, as compared to the 8¼-in. width of the JK and K, and the 15½-in. length of type Type K. Westinghouse Electric Corp.

▲ For details, circle 47 on Post Card

METAL SHELVING features aluminum teamed with steel

In Key-Way Shelving, a simple aluminum key locks and supports all parts. It is used in conjunction with strong, light aluminum T uprights and steel shelves. The aluminum T uprights have a bright, natural finish and rectangular slots at 1-in. intervals. Since



the supporting key covers but one slot in the upright, shelves may be installed closely above one another, if desired. Once inserted, the key supports either a single shelf or two adjacent shelves at the same height. It is pointed out that if you want to close the end of a shelf with a metal Key-Way panel, the key not only supports the shelf, but locks the panel in position as well. Shelves are reinforced at corners with welded 12-gage steel angle. Where heavy loads required additional shelf strength, reinforcing bars can be added. W. R. Ames Co.

▲ For details, circle 48 on Post Card

MASONRY PAINT protects against weather, corrosives

Rub-R-Kote is described as a polyvinyl acetate-base masonry paint which forms a protective coating resistant to acids, alkalies, lime and weather. According to manufacturer, there is no blistering, chipping, cracking, fading,

HOW AP PLATFORM TRUCKS RESIST WEAR EVEN ON HEAVY-DUTY APPLICATIONS

AP Pressed-Steel Construction No Warp...No Crack...No Splinter

AP Platform Trucks are extra-rigid, practically indestructible . . . designed and built of *pressed steel* to resist wear over a long, severe service life. They deliver a greater pay load every trip—whether used singly or as units of a motorized towing system.

AP trucks do not warp, crack or splinter—as wood-construction types so readily do even on easy duty. And AP offers light weight; smoothly rounded corners; end racks and bar handles that fit firmly into sockets; a modern appearance you can keep like new.

AP Platform Trucks are available in 3 series with capacities for every need: "L" (1,000 lb), "M" (1,800 lb) and "H" (2,750 lb). Prompt delivery from your AP-Franchised Distributor—your unified source of wheeled materials handling equipment. Call him—today!

TRAILER ATTACHMENTS

All Series "M" and "H" AP Platform Trucks are adaptable for either MANUAL (*top*) or AUTOMATIC (*bottom*) Trailer attachments for use with motorized towing systems. Units are factory-supplied and consist of either a manual or automatic hook assembly.

AP
THE AMERICAN PULLEY COMPANY
4200 WISSAHICKON AVENUE • PHILADELPHIA 29, PA.
A division of VAN NORMAN INDUSTRIES INC.
2390
For more facts circle 629 on Reply Card

Belmont Packings are the "Better Buy" Because...

① **Most complete line** * to choose from in finding the exact answers to your Sealing Problems. You won't be sold a "Just-as-good".

② **Easiest to get...from** convenient Local Industrial Distributors, geared to your needs. Find the Belmont Distributor nearest you in Conover-Mast Purchasing Directory. He is always available when you need him.

* HIGH PRESSURE ASBESTOS • ROTARY PUMP PACKINGS • VALVE PACKINGS • V-RINGS • LEATHER PACKINGS • SHEET PACKINGS AND GASKETS • HYDRAULIC & PNEUMATIC PACKINGS • METALLIC PACKINGS • PLASTIC PACKINGS • TEFLON PACKINGS & GASKETS • SPIRAL WOUND GASKETS

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THE BELMONT PACKING & RUBBER COMPANY • PHILADELPHIA 37, PA.

For more facts circle 630 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

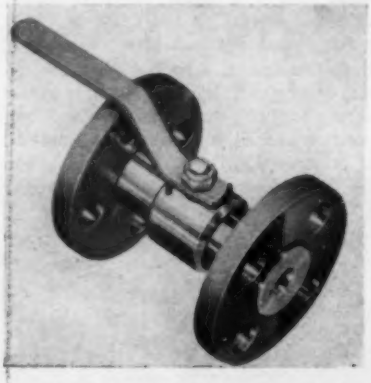
peeling and staining, and the coating is also impervious to grease and oils and unaffected by moisture. Rub-R-Kote seals and decorates brick, flexboard, concrete, Transite, cement, asbestos siding, stucco, cinder block, stone, tile and other masonry surfaces —new or old construction. It can be applied to damp or wet surfaces, where it lets moisture escape through its film without peeling. It is applied with brush or roller and dries within an hour to a velvetly low lustre. Covering capacity, depending on porosity of the surface, is given as 200 to 500 sq ft per gallon. It costs under $6.00 per gallon in 5-gal pails; comes in black, white and 10 decorator colors. Consolidated Paint & Varnish Corp.

A For details, circle 49 on Post Card

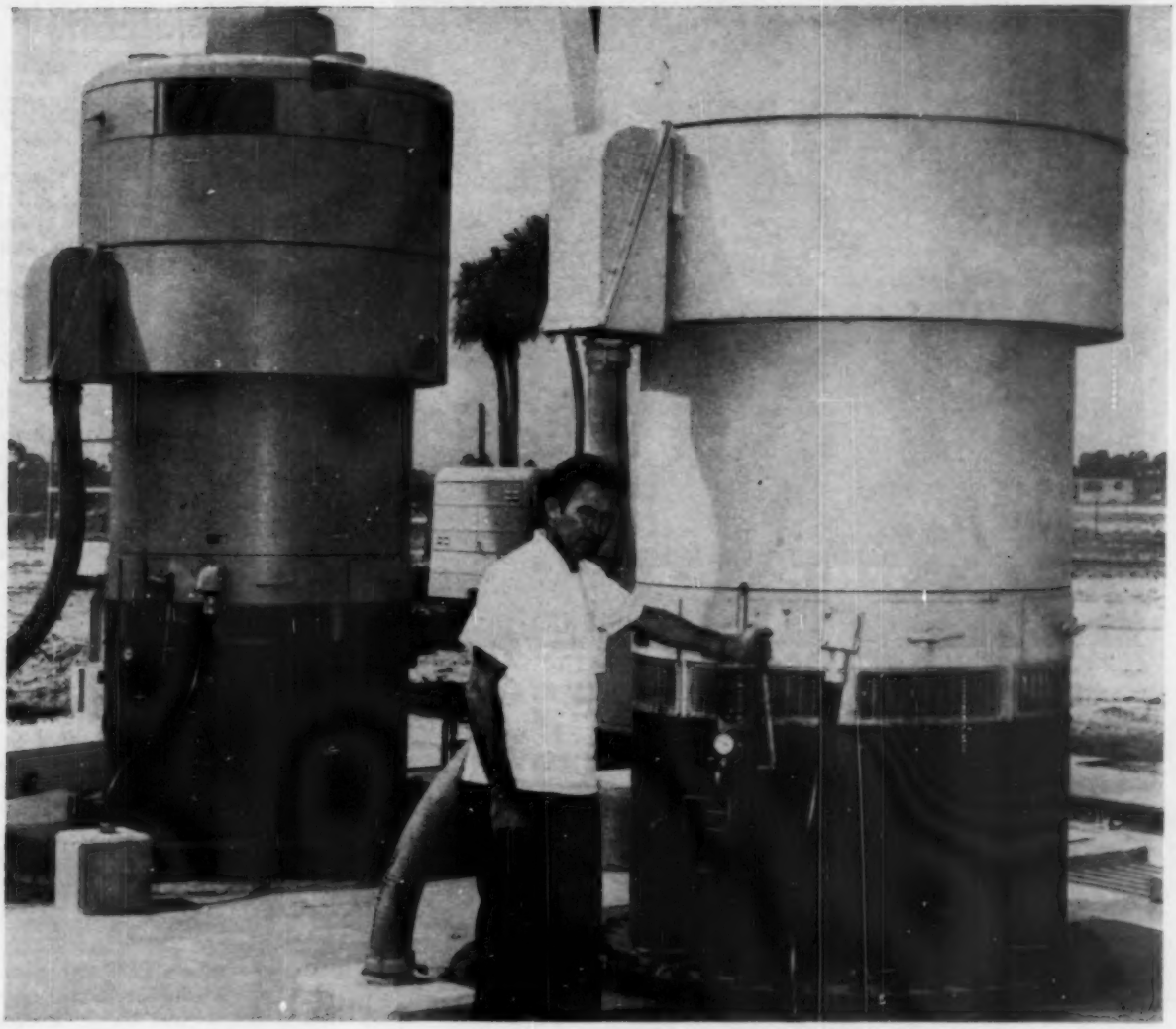
It's easy to obtain product data with the postage-free Reader Service Card provided on pages 301-302. Use them for information on advertising products, too. Just circle the key number appearing at bottom of the ad.

BALL VALVES have flanges which rotate around adapter

Flanges which rotate freely around an adapter are designed to simplify installation of McCannaflo Flanged-End Ball Valves. The piping flanges can be installed without regard to position of holes. When installing valve, its flanges



are lined up with pipe flanges and bolts drawn up loosely. Valve can then be rotated full 360 deg in the line to position handle at any point, following which bolts are tightened. Valves are



Cast to last—with Nickel. Suction bells, diffusers, column sections and discharge elbows for both of these new pumps at a Florida power plant are made of 2% nickel cast iron. With its tight, uniformly dense grain structure, nickel cast iron improves pressure tightness, increases tensile strength.

Stepping up fluid handling efficiency

Nickel-alloyed castings meet a wide variety of needs

Are you working with higher loads, higher pressures or higher temperatures than ever before? Then you'll want to know more about the nickel-alloyed cast irons.

Six different types of nickel cast iron, corresponding to ASTM specifications, can be adjusted to meet almost any specific service need.

Widely used throughout industry, nickel-alloyed iron castings offer the plant engineer a number of important advantages. Among them:

- Improved tensile and compressive strengths
- Ready machinability with good physical properties
- Greater resistance to wear
- Good castability (and uniform density throughout light and heavy sections)
- Improved rigidity
- Uniform response to heat treatment
- Improved resistance to heat and thermal shock
- Pressure tightness

You'll do well to specify nickel cast irons for original fluid handling construction, as well as for replacement parts in compressors . . . pumps . . . valves . . . cylinders . . . liners and miscellaneous equipment.

Want the full story? Complete information on all the nickel cast irons can be found in our 28-page illustrated booklet, "Engineering Properties and Applications of Nickel Cast Irons." We'll be glad to send you a copy. Just ask for "Bulletin A-69" when you write. A post card will do.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL MAKES CASTINGS PERFORM BETTER LONGER

For more facts circle 631 on Reply Card

Around-the-clock operations at the Champion Paper and Fibre Company's sprawling Pasadena, Texas, plant called for illumination of a million square feet of wood storage area. And just thirty-two 1,000-watt Wide-Lite area lights were required to provide the answer – uniform coverage without distracting glare or dangerous dark areas.

Designed especially to enhance the unique characteristics of color-corrected mercury vapor lamps, Wide-Lites bring *new dimension* to area lighting. They produce broad patterns which provide smooth, even coverage without hot spots or dark shadows. The patterns may be accurately plotted to determine the exact number of units needed to provide any desired level of illumination.

Ruggedly constructed from cast aluminum alloy, Wide-Lites are finished in aluminum epoxy paint for corrosion control. Outdoor models are sealed with tempered glass lens, and re-lamping is accomplished without disturbing the seal of the lens. Exclusive built-in heat radiating fins limit lamp temperatures to the most efficient range. A choice of reflectors is available on all models, and sizes range from 100 watt to 1000 watt.

To assist you in planning efficient working coverage of outdoor working areas, Wide-Lite engineers have prepared a unique group of transparent plotting curves. Write today for your set!

WIDE-LITE

manufactured by
WIDE-LITE CORPORATION
P. O. Box 191 • Houston 1, Texas
In Canada: Wide-Lite Division of Wakefield Lighted Limited London, Canada

OUTDOOR AREA LIGHTS • INDOOR LUMINAIRES • SPORTS LIGHTS • PROTECTIVE LIGHTS

For more facts circle 632 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

furnished in ½- through 2-in. sizes, in carbon steel, bronze, and 303 and 316 stainless, with 150 or 300 lb raised-face cadmium-plated carbon steel flanges. Hills-McCanna Co.

▲ For details, circle 50 on Post Card

ELECTRONIC CONTROL keeps materials at safe level

Fail-safe operation is claimed with the Model L-400 Flo-Level, for material level surveillance and control or for quantity measurement in processing and storage containers. It is reported especially suited for use with powdery or granular products. A rotating paddle in the container controls the generation of a small signal. A transistor circuit increases this signal and operates electrical contacts to control equipment or operate indicators to correct unsafe conditions. Control contacts are rated at 2 amp at 110 v a-c or 1 amp at 220 v a-c. It is explained that if any portion of the instrument fails, the control contacts operate automatically (without electrical actuation) in the same manner as when the material reaches a predetermined level. The unit may be had for high-level or low-level operation. Self-contained, it mounts on a 1¼-in. pipe coupling, and its internal assembly can be removed without unsealing tank or hopper. The series includes standard and heavy-duty units, which are available with explosion-proof housings and stainless steel fittings. Flo-Tronics, Inc.

▲ For details, circle 51 on Post Card

GREASELESS LUBRICANT sprays on sliding surfaces

Poly-Powder is a dry, greaseless lubricant which can be sprayed onto sliding surfaces or moving parts. Made

As a public service to those in business and industry who are responsible for the protection of lives and property from the hazards of fire.

FIRE RESISTANT INCOMBUSTIBLE FLAME RETARDANT FIRE PROOF PROVE IT! FLAME-PROOF NON-FLAMMABLE

MATERIALS FOR PROTECTION OF THERMAL INSULATION AGAINST FIRE DAMAGE

FIRST, to clear up a common misconception about materials used to protect thermal insulation; no coating, sealer, or adhesive can by itself prevent fire damage. In fact, certain products without fire-retardant properties many times will actually cause fire and flames to spread; while products containing fire-retardant properties can at best only retard the spread of flames by the reduction of available fuel.

Over the years many ambiguous and ill-defined terms have been used to describe fire resistant properties of materials in literature, specifications and other published data. Words and phrases such as incombustible, flame-proof, non-flammable, fire resistive, and even fireproof have been attached to products used for the protection of thermal insulation. In many cases where the use of these terms was based on unrecognized and inadequate test methods, the products actually fed fuel to the flames rather than retarding them.

The only accepted measure of fire hazard in coatings is the flame-spread value. The confusing phrases used above do not give in exact terms the flame-spread value. If the confusion is to be eliminated, Industry must adopt a standardized system of testing and terminology for use in Engineering Specifications.

The use of confusing terms can be discarded by the adoption of the rating standard known as the Flame-Spread Index, accepted and used by building codes and insurance underwriters. There are two test methods accepted by Industry for determining flame-spread values. These are the Underwriters' Laboratories' "Tunnel Test" (ASTM E84) and the National Bureau of Standards "Radiant Energy Test" (Interim Federal Standard .00136—Com. NBS). With either of these established methods, flame-spread values ranging from zero to over 200 can be determined with accuracy for all coatings, adhesives and sealers used with thermal insulation materials.

An example of flame-spread values:

A totally incombustible material such as portland cement would have a flame-spread value of zero, while a self-extinguishable synthetic resin product could be rated about 60, and a violently combustible nitrocellulose product would be rated at "over 200."

Here, also, are the flame-spread values of some popular insulation weathercoatings applied over calcium-silicate insulation:

VAPOR BARRIER ASPHALT MASTIC	
Product A	175
Product B	173
Foster C. I. Mastic 60-26	170
FIBRATED ASPHALT EMULSION MASTIC	
Product A	218
Product B	200
Foster H. I. Mastic 90-07	150
FIBRATED POLYMER EMULSION MASTIC	
Product A	290
Foster Sealfas Mastic	40
FIRE RESISTIVE VAPOR BARRIER MASTIC	
Foster Fire Resistive Mastic 60-60	35

The Solvent Problem

Flame-spread values of solvent type mastic weathercoatings are determined under solvent free conditions to simulate service conditions existing after the products have been applied and all traces of solvent have evaporated. However, during application and cure, a fire hazard will exist when flammable solvents are contained in the coating. Such solvents having a flash point lower than 100° F. are flammable and easily ignited by welding sparks, matches, electrical sparks, cigarettes, etc. Thus a product, whose flame-spread index under solvent free conditions is relatively low, could well be the cause of a disastrous fire while it is being applied if it contains a flammable solvent.

Therefore, for complete fire safety, where welding and other sources of sparks and flame cannot be avoided during application of coatings and adhesives, these products should be chosen not only for their ultimate flame-spread value, but also for their formulation with non-flammable solvents (for example, Foster Fire Resistive Mastics).

Recommendations

We urgently recommend that engineers who specify fire resistive coatings, sealers and adhesives for use with thermal insulation specify maximum acceptable flame-spread values and flash points of materials. Only by rigidly adhering to such specifications will owners, their inspectors, buyers and applicators obtain fire safe thermal insulation construction.

A Word of Caution

The mere publishing of a flame-spread value is insufficient evidence on which to choose a product. Where two products, equivalent in every other respect, are offered for fire safe service, a product with a flame-spread value of 6 should unquestionably be chosen over a product whose index is 44. *Relative* flame-spread values, then, become of vital importance in choosing fire-retardant products.

Purpose

We at the Benjamin Foster Company have been devoting many years to research, study, manufacture and promotion of fire safe products for use in the protection of thermal insulation. We have adopted a firm policy regarding our promotion of fire safe products which is:

"To cooperate with all interested individuals and organizations in the establishing of a standardized system of testing and rating true flame-spread value . . .

To publish information that will be factual and in accordance with accepted practices . . .

To avoid overemphasis of disaster conditions in the promotion of fire safety . . .

To continue our research and development of products with improved fire safe characteristics."

If there is any way we can be helpful to you or your organization in a better understanding of products for use in the protection of thermal insulation, please contact your nearest Foster Representative, or write Benjamin Foster Company, 4635 W. Girard Avenue, Philadelphia 31, Pa.

foster COATINGS · SEALERS · ADHESIVES for thermal insulation

DIVISION OF AMCHEM PRODUCTS

EFFICIENT REMOVAL OF DUST AND CHIPS

• SNAGGING • GRINDING • CHIPPING
• MACHINING • BUFFING • POLISHING
and similar operations

Whatever your problem in industrial dust control, call on Kirk & Blum, an organization of engineers and mechanics with more than 50 years' experience in this specialized field.

You secure a complete service from Kirk & Blum . . . DESIGN, FABRICATION and INSTALLATION . . . with a single responsibility for an *efficient* dust control system.

For an analysis of your dust control problem, call on Kirk & Blum's expert engineering service. Write today for complete information and a K & B survey.

The Kirk & Blum Manufacturing Co.
3189 Farrer Street
Cincinnati 9, Ohio

KIRK & BLUM
DUST CONTROL SYSTEMS

For more facts circle 624 on Reply Card

PLANT ENGINEERING EQUIPMENT

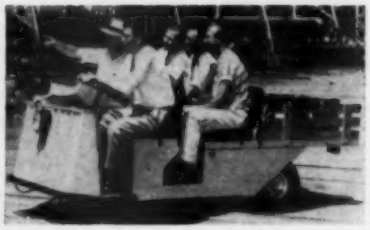
(Begins on page 214)

from Teflon, it is described as odorless, colorless, tasteless and non-staining, and having the lowest coefficient of friction of any solid material—only 0.016 to 0.024 against polished steel surface. Operating temperature range is from –450 to 400 F. Poly-Powder is designated a universal lubricant because it can be used on wood, metal, rubber, plastics, leather, glass and other materials over broad operating conditions. A free sample is offered qualified plant engineers. Polydoris Products Corp.

▲ For details, circle 52 on Post Card

PERSONNEL TRUCK seats five; holds supplies, too

The Cushman 734 Truckster, a three-wheeled vehicle, carries an operator and four passengers and has a 45⅝ by 41½ in. flatbed with stake racks. It is rated at a 1000-lb payload capacity plus five riders. It will operate in 50-



in. passageways and deliver up to 50 miles without recharging. The unit's rear seat can be removed to allow space for more equipment. It features a 2.5-hp 36-v d-c motor and steel reinforced positive belt drive. It has automotive type steering gear with a wheel diameter of 15 in. A speed selector switch offers two forward speeds and one reverse. Speed is further controlled by an automotive type controller pedal to start and stop the vehicle. It also has an 18-v headlight, tail light, stoplight and horn. Its speed ranges up to 15 mph forward, 6 mph in reverse. Cushman Motors.

▲ For details, circle 53 on Post Card

LARGE DIAPHRAGM VALVE is packless, Penton-lined

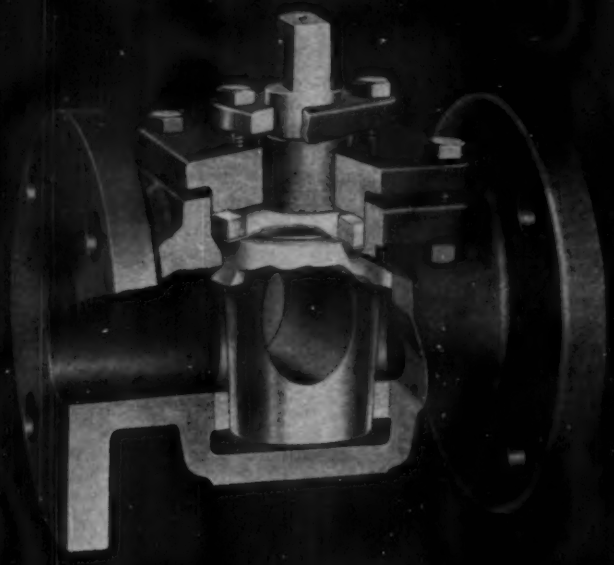
This 8-in. flanged-end Penton-lined packless diaphragm valve is available with a cast iron or aluminum body and with a variety of diaphragm materials. Typical services include on-off and throttling control of acetic acid, butadiene, hydrofluoric acid,

WHAT USERS SAY ABOUT THE NEW DURCO TYPE G SLEEVELINE

The new Durco Type G SLEEVELINE is a non-lubricated plug valve. A Teflon sleeve is pressed into a ductile iron or stainless steel body; a machined plug, Teflon diaphragm and gasket, a thrust collar, and a self-aligning adjuster make up the rest of this trouble-free, non-lubricated plug valve.

Available in ductile iron or stainless steel, screwed or flanged ends from ½" through 2", and in ductile iron flanged ends 3", 4", and 6". 150 psi rating.

Write for bulletin V/12.



sulfuric acid service

"Entirely satisfactory in service on 66°Bé sulfuric acid after 8 months."

latex user

"Valve on Latex service since May 1, has given no trouble. Other valves (gate, globe, ball, wedge, lift plug) failed because Latex build-up froze the valve."

chlorine gas service

"In service for ten months on chlorinator handling dry chlorine gas at 50 psi —ambient temperature. Formerly used lubricated valve which gave considerable trouble due to freezing."

caustic service

"Valves used on cell liquor, concentration 12%, at 160°F. After one month valve was removed and inspected. All movable parts were free, no wear was evident. Valve was reinstalled and has been in six months continuous service with completely satisfactory performance."

phosphorus user

"Used on yellow phosphorus at 160-200°F. Valves are doing fine. Thanks for a product that works—and a valve that I can turn with one hand without breaking my back."

solvent handling

"Valves performing very well on toughest solvent service after five months, where lubricated plug valves were regularly replaced due to sticking caused by leaching out of lubricant."

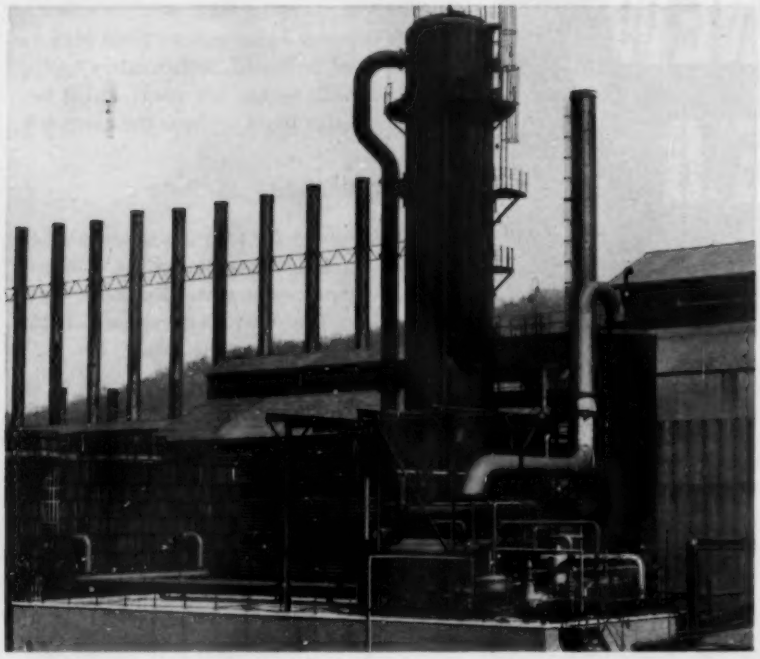
DURCO
CORROSION RESISTING ALLOYS & EQUIPMENT

THE DURIRON COMPANY, INC., Dayton, Ohio

Valves • Pumps • Filters • Process Equipment

For more facts circle 635 on Reply Card

HAGAFILM®
eliminates reboiler corrosion problem at Clairton Works



Quick case history—reading time 58 seconds

THE PLANT: Desulfurization Plant at the Clairton, Pa., works of United States Steel Corporation uses steam to heat the reboilers on a stripper column. Condensate formed in the reboilers is collected and used as make-up for two 10,000 pound-per-hour boilers in the Open Hearth area.

THE PROBLEM: Lime-soda softened Monongahela River water, used as make-up, produces steam high in CO_2. Soon after start-up, the condensate control valve plugged with corrosion products. Tests conducted on the condensate indicated the presence of 0.25 ppm total iron and 8 ppm of CO_2. U. S. Steel engineers were concerned not only about the obvious corrosion but about the possible serious damage to the Open Hearth boilers resulting from entry of iron oxide corrosion products.

THE SOLUTION: Hall Laboratories engineers recommended 1) installation of vents in the reboilers and 2) the feed of Hagafilm into the steam to reduce corrosion. U. S. Steel followed both of these recommendations immediately.

TEST RESULTS: Six weeks after introduction of Hagafilm, corrosion rate was reduced to less than 0.1 mg/dm²/day. Three months later the rate was down to 0.03 mg/dm²/day, and the total iron has been reduced from 0.25 ppm to 0.05 ppm. Corrosion tests in this system are now conducted yearly. The latest check of preweighed test panels indicated a corrosion rate so low the same panels were re-exposed for a second year without further evaluation.

FOR FULL INFORMATION on how Hagafilm can solve your corrosion problems safely, quickly, and economically, write for Bulletin 410-12-7 or contact:

HAGAN
CHEMICALS & CONTROLS, INC.
HAGAN CENTER, PITTSBURGH 30, PA.

HAGAN DIVISIONS: CALGON CO., HALL LABORATORIES, BRUNER CORP.
For more facts circle 636 on Reply Card

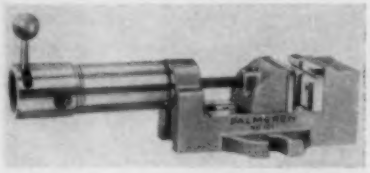
PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

lubricating oil, natural gas, sodium cyanide, sulfuric acid, zinc sulfate, and other liquids and gases. It is designed for maximum pressure of 100 psi and temperatures to 240 F, depending upon pressure. Resilient diaphragm isolates working parts from line media and is said to seat tightly even against solid particles in flow. Hills-McCanna Co.
▲ For details, circle 54 on Post Card

AIR VISE speeds up light drilling, tapping, assembly

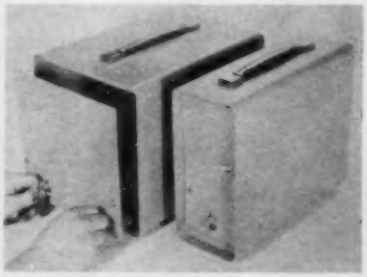
Palmgren Model 121 Air Vise has a jaw width and jaw opening of 1½ in., and a jaw depth of 1 in. It is only 1¾ in. high. It has a 1⅛ in. diam stainless steel air cylinder with ad-



justable stroke, and air cylinder and valve are combined in one unit. Overall length of vise and cylinder is 8 in. Any available air supply will operate vise. Chicago Tool & Engineering Co.
▲ For details, circle 55 on Post Card

INSTRUMENT CASE available as off-the-shelf design

This is designed as an integral part of company's plug-in construction system as a standard, off-the-shelf case for test instruments or as carrying case for plug-in replacement chassis. Plug-in chassis is locked in



or removed by half-turn of cam lock. Open-sided chassis permits use of snap-in terminal cards mounted in vertical planes of circuitry. All leads are brought to an accessible point-of-check that can be graphically identi-

you get **MEASURABLE ADVANTAGES** with General Electric Control

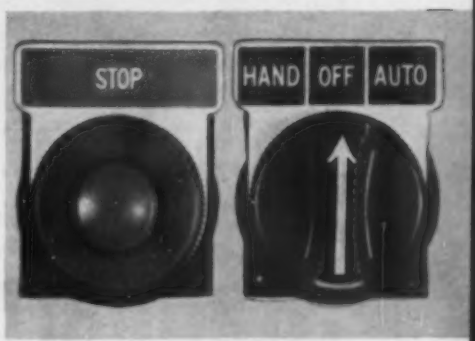
New General Electric miniature push buttons cut panel space 40%. Twelve-unit miniature station (left) is shorter, narrower than twelve-unit heavy-duty station (above).

First industrial miniature oil-tight pushbutton line allows design innovations on your equipment

For the first time, control panels and industrial machines can be built with *miniature* oil- and dust-tight pushbutton units, designed specifically for the reliable operation required in industrial applications.

With the new General Electric CR-104 miniature oil-tight pushbutton line, space can be reduced 40%. And, you can get the operating and functional units presently available in heavy-duty oil-tight forms. Color coding is available in *both* operators and rings to provide greater flexibility in color combinations, and the attractive appearance enhances the design of your machines. Units, illuminated forms, pendent stations, and enclosures to accommodate from four to 42 units are available *now*.

For more information on this outstanding new development in control—and the "measurable advantages" it offers—contact your nearby G-E Apparatus Sales Office, or write for bulletin GEA-7127, General Electric Co., Schenectady 5, N. Y. 811-14



Actual size G-E miniature oil-tight pushbutton and selector switch units.

Progress Is Our Most Important Product

GENERAL ELECTRIC

For more facts circle 637 on Reply Card

THOROSEAL
Waterproofs
and decorates

WATERPLUG
Cement to stop
water flow

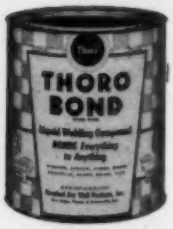
Question:

Maintenance men: Are you searching for a sure way to prevent or cure spalling, cracking and water seepage in masonry?

Answer:

If so, you should learn more about the THORO SYSTEM. Since 1912, Standard Dry Wall Products Company has engaged in no other business than the protection of masonry. Through constant research and development its products have become the foremost professional products in the field. You'll save money by using the best. Write for our free specification guide.

THORITE
Non-shrink,
non-slump
patching
mortar



THOROBOND
Bonding agent
for concrete
and plaster

THOROSHEEN
Acid, alkali
and mildew
resistant paint

THOROCLEAR
A silicone
transparent
sealer

Please send new 20-page specification guide describing all products and uses.

Name_____

Company_____

Address_____

Standard Dry Wall Products, Inc.

Box X-10, New Eagle, Pa.

Plants at New Eagle, Pennsylvania and Centerville, Indiana

For more facts circle 638 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

fied with circuit legends. It is available in 2-, 4-, and 8-in. widths, 10-in. heights. Alden Products Co.

▲ For details, circle 56 on Post Card

GAGELESS REGULATORS for gas cylinder use

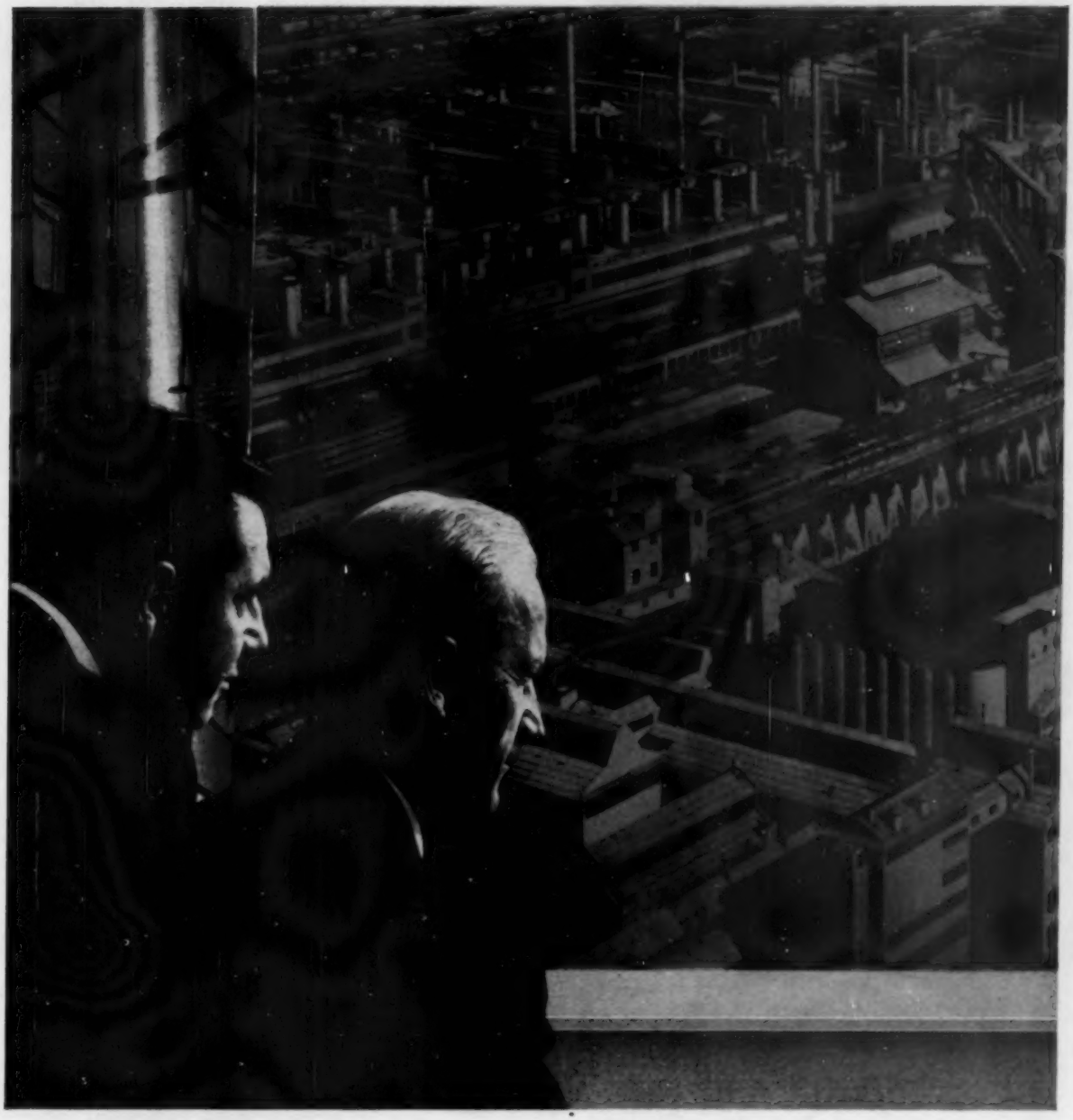
Two-stage gas pressure regulators without conventional glass covered gages are available for both oxygen and acetylene cylinder use in welding, heating or cutting operations. These gageless regulators are reported particularly useful where rough usage is encountered, and where continuous quality performance is necessary.

Delivery pressure is set with a micrometer type indicator. Two ranges of regulation are available by means of a low-high marking on the adjusting knob, and three lines on the spring case. The position of the knob in relation to the lines on the case determines whether high or low readings apply. The gages also have a cylinder pressure indicator visible at the top of the regulator and protected by a brass housing. The line includes an oxygen regulator with maximum work pressure of 100 psi and two acetylene regulators with maximum work pressure of 15 psi. Conversion kits for changing conventionally gaged regulators in the same class to gageless types are also available. Air Reduction Sales Co., Div., Air Reduction Co., Inc.

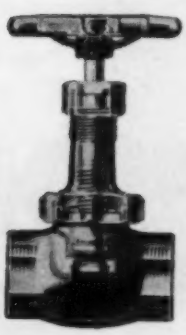
▲ For details, circle 57 on Post Card

DEMONSTRATION UNIT helps teach electronics

Designed to teach basic principles of electronics from fundamental circuits through radio, television and radar, the Electronic Dynamic Demonstrator features a 3-by-5 ft breadboard to be



The LUNKENHEIMER Valves in your *competitor's* plant are the valves that cost *you most!*



L-460-6A

- BRONZE
- IRON
- STEEL
- PVC

With quality Lunkenheimer Valves in his plant, your competitor enjoys far fewer leakage, production and maintenance losses. Thanks to these savings, he lowers his manufacturing costs . . . and makes more profit. Why give him this important advantage? Install Lunkenheimer Valves . . . famous for quality and performance for nearly a century. The Lunkenheimer Co., Cincinnati 14, Ohio.

You can't find the cost of a valve on a price list.

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

For more facts circle 639 on Reply Card

at CHRYSLER...

REMOVING CHIPS FROM WATER PUMP PASSAGE HOLES AFTER MACHINING. CHRYSLER ENGINE PLANT, DETROIT, MICH.

SPENCER
VACUUM CLEANERS

• GUARD QUALITY
• CUT ASSEMBLY COSTS

Operations performed here by Spencer vacuum cleaners include:

• Removing chips during assembly of head to block • Cleaning oil filter pad inlet passages • Automatically cleaning bearing cap assembly on block • Automatically removing core sand from engine block castings • Cleaning floors and conveyors.

In large plant or small... for maintenance or production needs... portable units or installed systems... whatever your requirements, it will pay to check with SPENCER.

REQUEST CATALOG #155B
ON "INDUSTRIAL VACUUM"

The SPENCER TURBINE COMPANY
HARTFORD 6, CONNECTICUT

For more facts circle 640 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

displayed blackboard style in a classroom. Also utilized are such equipment as a large classroom size meter, picture tube and housing, mobile stand, a Simpson Model 311 VTVM (with switch installed to permit switching of reading to the classroom demonstration meter), and a teacher's manual and course of study.

The demonstrator is assembled and studied, circuit by circuit, with parts connected or disconnected by a device requiring no soldering joints. Fundamental principles of physics, electricity and electronics are introduced where applicable. Shorting bodies and defects can be inserted at any point, so that visual and auditory diagnostic procedures can be demonstrated. Complete equipment costs around $610. Transvision Electronics, Inc.

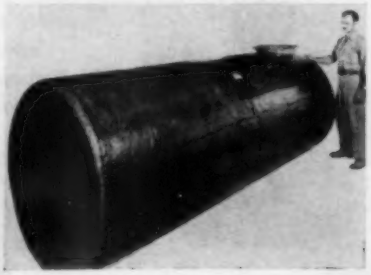
A For details, circle 58 on Post Card

Use the Reader Service Cards provided on page 301-302 to ask for more information on this equipment. Circle item numbers of products in which you are interested.

HEAVY DUTY TANKS of glass-reinforced polyester

High corrosion resistance and strength at low cost are claimed for these glass-reinforced polyester tanks for storing and processing corrosive liquids. In vertical or horizontal types, tank capacities range from 20 to 20,000 gal, with many capacities produced as stock items from standard parts. Manufacturer recommends these tanks for replacing steel or lined ones in many applications where longer service and/or lower cost are desired. They are also lighter—a 1000-gal size weighs about 350 lb as compared with 1000 lb for a comparable stainless steel tank.

The tanks are fabricated from a



The learned buyer of motor control centers

The circuit breakers hardly show on a modern motor control center. But they do the work. Get good circuit breakers and you get good protection . . . extra insurance of continuous electric power . . . lowest net cost. Get poor breakers and you invite trouble. What make can you buy most confidently? Motor control center builders prefer I-T-E over all other makes. Better value. Yet costs no more.

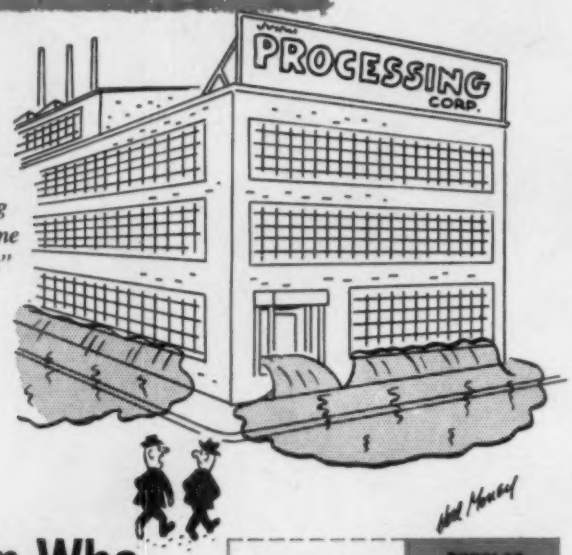
Write for the new bulletin on I-T-E molded case circuit breakers. I-T-E Circuit Breaker Company, Dept. SA, 1900 Hamilton Street, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

For more facts circle 641 on Reply Card

For more facts circle 640 on Reply Card

Life in these excited states...



"Sunday morning is no time to call me about a little leak"

For Men Who Work 24 Hours a Day

Like the phone ringing when you're in the shower, corrosion and contamination wait for no man. Best way to confine it to normal working hours is to specify trouble-free Ace chemical-resistant equipment by American Hard Rubber Company. Best for the money anywhere... backed by 108 years of experience.

All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. *Bul. CE-56.*

Improved design... now 12 gpm. All wetted parts acid-resistant, wear-resistant Ace hard rubber. Finest available. *Bul. CE-55.*

Flexible poly pipe, ideal for water lines, drains, underground pipe or conduit. Sizes ½ to 2", long coils, NSF-approved for drinking water. *Bul. CE-57.*

World's best chemical valves ... at moderate prices. All-plastic, rubber-lined, or all-hard-rubber. ⅛" pet cocks to 24" gate valves.

ACE *chemical resistant equipment*
BY AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
ACE ROAD • BUTLER, N.J.

See ACE equipment in Chemical Engineering Catalog

For more facts circle 642 on Reply Card

PLANT ENGINEERING EQUIPMENT

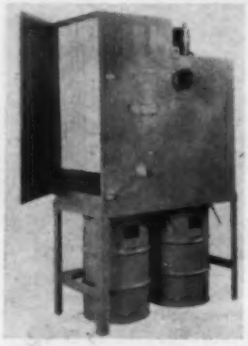
(Begins on page 214)

bisphenol-A polyester resin (Atlac 382 of Atlas Powder Co.) reinforced with glass fibers. Tests are reported to show that bisphenol-A polyester is more resistant to prolonged contact with most acids, alkalies and bleaches at high temperatures than general-purpose or other polyesters. A two-step fabricating process contributes to the tanks' high strength-to-weight ratio. The first step involves application of a "barrier coat" of the polyester at the tank's inner surface. In the second step, build-up of the main body, a process is used to achieve a high glass content for durability and impact resistance. Observation of liquid level within tank is possible due to translucence of the structure. Justin Enterprises, Inc.

▲ For details, circle 59 on Post Card

DUST COLLECTOR has high rating, efficiency features

Master Model 1200 Dust Collector with a 1200 cfm rating and other efficiency features is adaptable to individual or group machines producing wood, metal or plastic dust, chips



or shavings. Number of machines that collector will handle, can be increased by using company's Ventomatic air control valves. Two 55-gal drums for collection of filtered-out material are included. A 3-hp motor furnishes suction through a 7-in. inlet. Fourteen filter bags of heavy flame- and mildew-proof cloth are designed to increase efficiency. The Kindt-Collins Co.

▲ For details, circle 60 on Post Card

CENTRIFUGAL FAN provides thorough ventilation

Model 6S is designed for operating at 10,000 rpm, with capacities ranging from 96 cfm at 6 in. static pres-

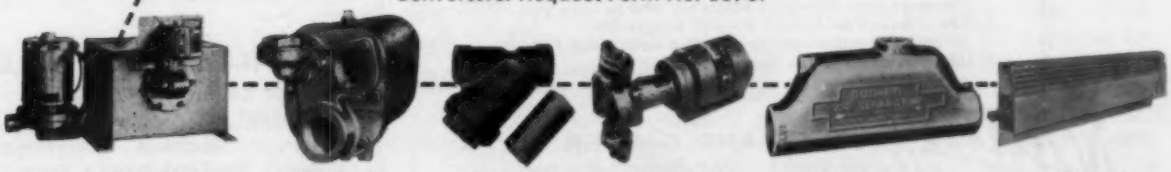
NEW DUNHAM-BUSH "SC" STEAM CONVERTER ELIMINATES "SHOPPING AROUND"!

It makes a lot of sense to deal with Dunham-Bush and enjoy "one source-one responsibility". Saves time! Saves money! Adds dependability!

Newest in the Dunham-Bush complete line of components for the whole system is the "SC" Steam Converter. Used primarily for heating radiation water with steam, the Dunham-Bush "SC" Converter offers distinct application advantages. Piping design is simplified and design work is reduced. The "SC" is your best bet for providing heating water for office space in industrial buildings. When applied to high buildings, "SC" keeps static heads at reasonable levels as well as simplifying piping design.

Write today for complete details of the new Dunham-Bush "SC" Steam Converters. Request Form No. 1570.

SAME PLACE YOU CALL FOR:



CONDENSATE PUMPS | F&T TRAPS | STRAINER | HOT WATER CIRCULATOR | AIR SEPARATOR | RADIATION

Plus a complete line of hot water heating specialties.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

WEST HARTFORD, CONNECTICUT • MICHIGAN CITY, INDIANA
MARSHALLTOWN, IOWA • RIVERSIDE, CALIFORNIA

SUBSIDIARIES

heat x — HEAT-X, INC., ROCHESTER, N.Y. — DUNHAM-BUSH (CANADA), LTD., TORONTO, CANADA

DUNHAM-BUSH, LTD., PORTSMOUTH, ENGLAND — DUNHAM-BUSH CANADA LTD., PORT HOPE, ONTARIO

For more facts circle 643 on Reply Card

Built for rugged service...

2 NEW

lightweight **floor trucks**

Here are 2 new trucks that feature corrosion-free properties plus strength without weight . . . up to 40% lighter than steel. This permits use in almost any industry plus larger loads and more trips with less energy, less manpower.

Nutting Structo-Lite Trucks are made of heat treated aluminum alloy, the same type used for heavy duty structures . . . non-sparking for safety where explosive material is used, non-toxic and resistant to attack by food and unaffected by most chemicals, and many acids and alkalies. Exclusive Nutting unitized frame construction holds proper alignment throughout unusual loads and abuse. New 3 bearing "friction-free" casters for easiest possible maneuvering.

Nutting Fiberglass Box Trucks weigh as little as 70 lbs. (steel trucks of the same size, 120 lbs.!) Chrome impregnated fiberglass is impervious to steam, oil and mild acids and alkalies — won't crack or corrode — withstands temperatures from —40°F to 212°F, even up to 250°F for short exposures. Smooth inside with rounded corners for easy cleaning.

These light, but extra rugged trucks are designed to increase your handling efficiency and to save you money — based on lighter weight, longer life, reduced maintenance and less downtime. For full information send the coupon today.

Nutting **TRUCK AND CASTER CO.**
492 Division Street • Faribault, Minnesota

_____Send Structo-Lite aluminum truck literature
_____Send fiberglass truck literature

NAME_____

COMPANY NAME_____

ADDRESS_____

CITY_____ STATE_____

For more facts circle 644 on Reply Card

PLANT ENGINEERING EQUIPMENT

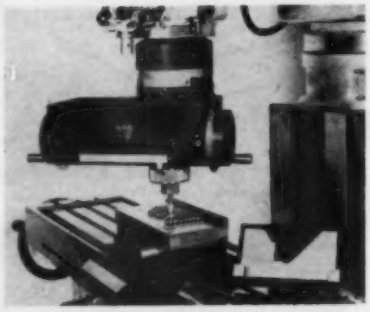
(Begins on page 214)

sure to 20 cfm at 10 in. pressure. Claimed particularly suitable for apparatus or installations requiring thorough ventilation or movement of air, as for cooling electronic tubes. Flexible housing can be rotated to change angle of air discharge. Bulletin 255-31 gives more information. Ilg Electric Ventilating Co.

▲ For details, circle 61 on Post Card

TEMPLATE CUTTER works directly from drawing

With Mimik Templator, tracing templates can be cut directly from drawing, company says, in 15 to 45 min. While the Templator is designed for use with Mimik Tracer, it will also cut

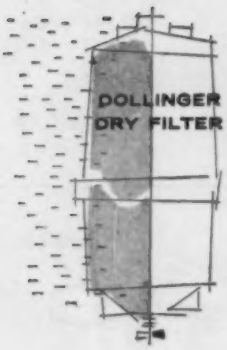


templates for certain other tracing equipment. Attached to any vertical mill, device uses 0.003-in shim stock and is sandwiched between two pieces of plastic to provide stiffness. Dial settings provide for any angle or radius and straight x and y dimensions are taken from machine tool table. Designed for small lot production, company says runs in 100's have been made with wear less than 0.0001 in. Mimik Tracers Inc.

▲ For details, circle 62 on Post Card

PENDANT-TYPE RECEPTACLE for ceiling mounting

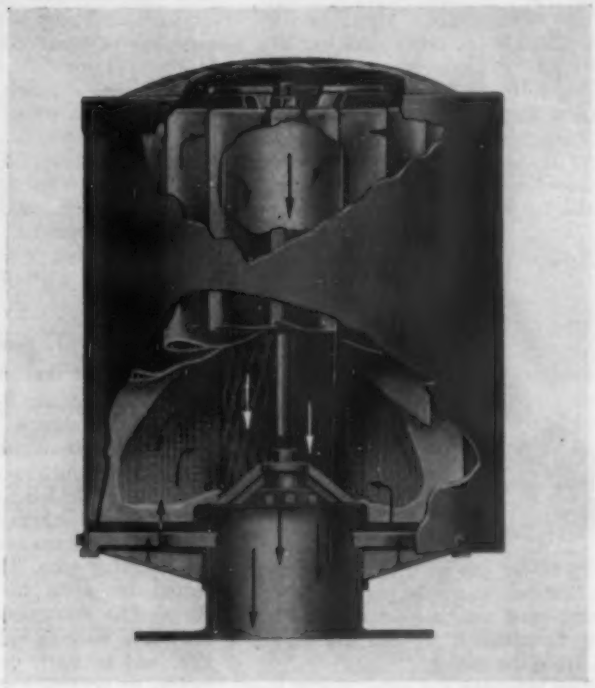
The CPSHC, a pendant type, explosion-proof receptacle incorporates company's dead-end contact feature. Any arcing is confined within a plug combustion chamber. Dual protection is afforded by elimination of live contacts exposed to atmospheres which may contain volatile, inflammable fumes, explosive vapors etc. For ceiling mounting, these receptacles are designed for use with company's Type CPP explosion-proof plugs. Of polished aluminum, the receptacles have ½-in. hub with set screw and are



SPECIALISTS
FOR 39 YEARS

LOWEST INITIAL RESISTANCE OF ANY DRY-TYPE INTAKE FILTER

Filters for internal combustion engines, compressors and blowers



DOLLINGER STAYNEW FILTERS are designed for direct application to engines, compressors and blowers or to outdoor piping without the need for foundations, supporting frames, or weather louvers. Staynew's Radial Fin Construction utilizes the very best filtering medium available. Offers the greatest active filtering area in any given space . . . low pressure drop with maximum efficiency . . . extended periods of service without maintenance. Threaded pipe connections or flanges make for ease and solidity of installation. For cleaning and inspection, the weather housing does not need to be removed—a small cover is taken off, a bolt unscrewed, and the insert merely lifted out; this is a major advantage in the case of very large models. Available with capacities ranging from 60 to 10,000 C.F.M. Multiple units available for larger capacities. Write for Intake Filter Bulletin 100. Dollinger Corporation, 55 Centre Park, Rochester 3, New York.

PROTECTOMOTOR

STAYNEW FILTERS

DOLLINGER

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS • ELECTROSTATIC FILTERS • MIST COLLECTORS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS • VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

For more facts circle 645 on Reply Card

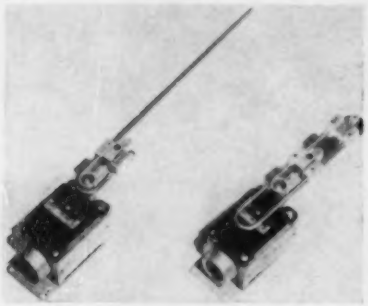
PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

rated 20 amp, 1 hp, 115 or 230 v, 60 cycles a-c, single phase and two-wire, three-pole. Appleton Electric Co.
▲ For details, circle 63 on Post Card

LIMIT SWITCH with extension arm feature

Designed to simplify installation at hard-to-reach locations on general machinery and conveyor systems, the CR9440 J1 is available with two extension forms: an adjustable radius roller lever and an extended arm lever. For use when a limit switch cannot be mounted closely to the part to be detected, the adjustable-radius roller



lever device can be used in conveyor applications where the parts to be detected must not be marred. The arm may be actuated between 2½ and 5 in. from the switch.

The extended rod lever switch has an operating radius of 10¾ in., permitting actuation up to that distance from the switch. Since location does not have to be as precise as with a normal limit switch, the installation of the extended arm limit switch is simplified. Allen screw and spline adjustment allows angular position changes when needed. A 20-deg overtravel is tolerated and movement up to 55 fpm is permitted with both forms. General Electric Co.
▲ For details, circle 64 on Post Card

OVERHEAD TRACK SWITCHES are roller gliding type

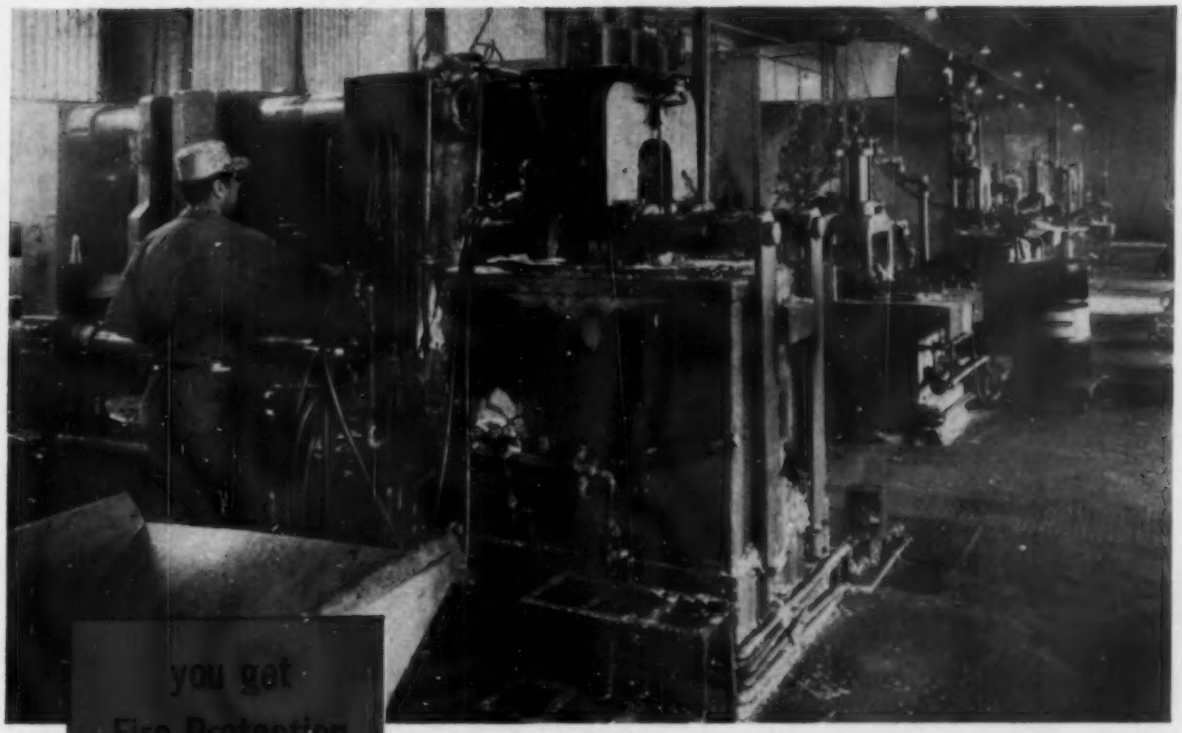
Types K and L Switches are of rugged steel construction, assembled in jigs for permanency of alignment, and designed for loads of 2000 to 4000 lb. Operation is claimed unusually easy because the inner track-carrying frame rides on anti-friction rollers. A latch mechanism holds the switch in position. Safety guards are provided to prevent carriers from running off open ends of incoming rails. The switches are designed for hard-service applications and manufacturer says that parts subject to wear may be replaced inexpensively. K and L Switches are available for left-hand, right-hand and three-way operation; for manually-operated and motor-propelled systems. They may be shifted by hand, electric or air power. A right-hand, non-electrified type is shown. Cleveland Tramrail Div., Cleveland Crane & Engineering Co.
▲ For details, circle 65 on Post Card

ALARM ROTAMETER with manual or automatic reset

Designed to measure fluid rate of flow and indicate abnormal high or low flows by electronic detection, Series 18200-C Rotameters use a standard rotameter with 5-in., 10-in. or 600-mm tube, and a high frequency pick-up sensing coil mounted flush against the metering tube. This coil is connected by cable to the electronic alarm. The instruments are made to activate a warning light or alarm device, and to start, or stop a pump, motor, or control unit.

Model E, which requires manual reset, can be used with two sensing

coils for high and low alarm settings. The float is outside the field of the coil during normal flow conditions. When the float enters and interrupts the pickup coil field, the sensitive relay drops out and de-energizes the coil in the power relay, thus completing the alarm circuit—which remains closed until the float returns



you get
Fire Protection
and
Wear Protection
with
HOUGHTO-SAFE

HOUGHTON
THE ONLY
COMPLETE LINE OF
PACKINGS & FLUIDS
FOR
INDUSTRIAL HYDRAULIC
SYSTEMS

Shown above are some of the machines in a mid-western die casting plant that have been operating with Houghto-Safe 600 series for up to 7 years!

Not one of these machines has been shut down because of pump failure due to faulty lubrication!

These machines have clocked over 25,000 hours with pump cartridges replaced only at scheduled overhaul periods. Here is the record:

Machine No.	Pressure (psi)	Hours Run on Houghto-Safe
1	1,000	17,794
2	1,000	20,096
3	1,000	25,496
4	1,000	15,128
5	1,000	25,596
6	1,350	18,122
7	1,000	20,162
8	1,750	5,376

Houghto-Safe 600 series is Houghton's *fortified* water-glycol type hydraulic fluid—and it is this unique fortification that gives this fluid its unusual lubricating qualities.

If you operate hydraulic equipment anywhere near open flame or high heat, you can protect your personnel and plant against hydraulic oil caused fires and protect your equipment against needless wear with Houghto-Safe. Write for new Houghto-Safe Bulletin to E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

Fortified Houghto-Safe ■ 600 Series—Water-glycol ■ 1000 Series—Phosphate-Ester ■ 5000 Series—Water-Oil Emulsion

Industry's Partner in Production

E. F. HOUGHTON & CO.

Philadelphia, Pa. • Chicago, Ill. • Carrollton, Ga. Detroit, Mich. • South San Francisco, Calif. • Toronto, Canada

For more facts circle 646 on Reply Card

Sundstrand Machine Tool Company, Belvidere, Ill.
—showing 4" Ribbed Embossed exterior of
Field Assembled Insulated Wall.

SECOND STORY REALLY
TELLS THE TALE . . .
NO MAINTENANCE WITH

REYNOLDS ALUMINUM

COMMERCIAL ROOFING AND SIDING

It's ladders and scaffolding—second story work—that makes maintenance men appreciate Reynolds Aluminum siding. Once it's up, you'll probably never have to get up there again. No protective painting needed . . . because aluminum can never rust and defies corrosive atmospheres that can destroy other materials.

Reynolds Aluminum roofing has the same freedom from maintenance. And roof and siding together give your building the advantage of high radiant reflection all around . . . improving the comfort of workers winter and summer . . . cutting the costs of heating and air-conditioning.

Available in Corrugated, 4" and 8" Ribbed Embossed, V-Beam and Roof Deck . . . all in natural aluminum *and in 20 New "Colorweld* 60" Colors*, embossed or mill finish. These materials also combined in Field Assembled Insulated Wall Systems. For full information call any Reynolds sales office. Or write to **Reynolds Metals Company,** Richmond 18, Virginia.

**Trademark of Reynolds Metals Company*

Watch Reynolds New TV Show "HARRIGAN AND SON" Fridays;
also "ALL-STAR GOLF," Saturdays—ABC-TV.

For more facts circle 647 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

to its normal operating position and the power relay is reset by the reset button. Model EV, with automatic reset, is used with one coil to detect deviations above and below a desired flow condition. The float is within the coil field during normal flow conditions. Bulletin 18A gives specifications. Schutte and Koerting Co.

▲ For details, circle 66 on Post Card

ELECTRIC UNIT HEATERS in capacities to 85,325 Btu/hr

Compact and good looking, Type LUH ElectricUnit Heaters have metal sheath Chromalox Fintube electric elements with built-in line voltage overheat protection. Wide fin spacing is used to permit efficient, economical

operation even in dirty atmospheres. The fan motor is totally enclosed and also has built-in thermal overload protection. A fan safety guard is provided, and there's a roomy junction box on top of the heater housing shell for easy connection from overhead wiring. Adjustable, horizontal louvers control air flow. Ceiling mounting is accomplished by rod-type hangers. Available optional equipment includes swivel-type wall mounting brackets and day-night automatic control system. Heating capacities range from 17,065 Btu/hr to 85,325 Btu/hr; power capacities from 5 to 25 kw and 208 to 480 v. Edwin L. Wiegand Co.

▲ For details, circle 67 on Post Card

REFLECTOR BULB is compact in size, versatile

This 50-w reflector bulb (50R20) throws a beam of controlled light suitable for such uses as close-up supplementary lighting for inspection. Because of its small size—about 2½ in. in diameter, 4 in. long—the lamp is

TEST MACHINE at a metal fabrication plant gets air from the Le Roi 100S2 shown below. Unit also supplies air for presses, automatic and manual welders, painting machines, and automatic assembly machines.

puts your plant air supply right where you need it!

LE ROI 100-HP STATIONARY COMPRESSOR

Trouble-free air-cooled LeRoi 100S2 delivers 450 cfm of air at 125 psi — yet takes up only 20 sq. ft. of floor space.

Any way you look at it, the Le Roi 100S2 two-stage stationary compressor is your best bet to lower your cost of compressed air.

It provides cool, clean airpower. And its compactness permits installation *near the point of use,* thus eliminating excess piping and costly waste of air. If you need more air, you just install more Le Roi S2 compressors — and you can still beat the cost of centralized air systems.

The electric-motor-driven 100S2 is easy to operate and maintain. Its Dual-Control permits either constant-speed or automatic start-and-stop operation. Air cooling eliminates plumbing and water line freeze-ups . . . permits indoor or outdoor installation. Balanced design reduces vibration and noise . . . extends compressor and motor life.

Put your compressed air system on a paying basis. Investigate the complete Le Roi line of unit-type and stationary air compressors — from ½ to 100 hp. Contact your Le Roi distributor, or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin. 86-05

LE ROI STATIONARY COMPRESSORS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

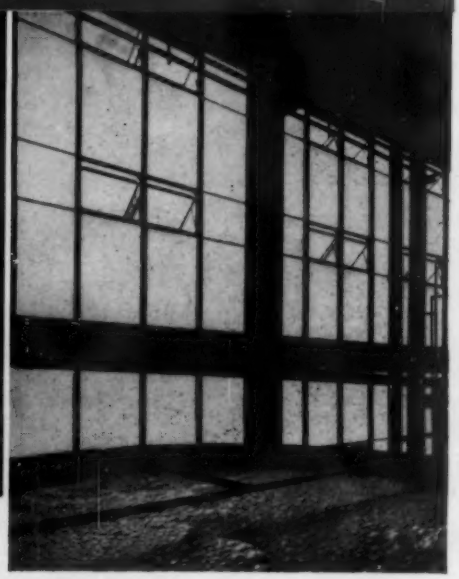
For more facts circle 648 on Reply Card

2.*
DAYLIGHTING DO's and DON'Ts
FOR COMFORT-CONSCIOUS ENGINEERS

* No. 2 of a series to help Engineers increase plant efficiency and economy.

DON'T expect to eliminate the harmful effects of "raw" sunlight through ordinary glass.

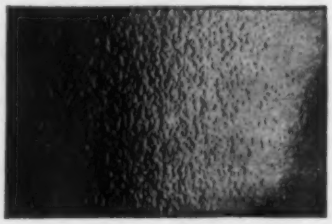
Today, most engineers realize the importance of proper factory lighting to boost efficiency and employee morale. Excess solar heat makes interiors uncomfortable . . . and blinding glare makes seeing tasks difficult and tiring.



DO INSIST ON COOLITE, HEAT ABSORBING GLASS

Blue-green Coolite, glare reduced, controls the quality of light flooding work areas, helps banish objectionable glare ... cuts costly eye fatigue that results in seeing errors and reduces solar heat up to 50%! That's quite an order but Coolite can do all this because Coolite filters out the unwanted factors in raw sunlight to help keep interiors cooler, brighter, more comfortable.

Buy, specify, insist on Coolite Glass. Available wired and unwired at better distributors of quality glass everywhere.



Send for Coolite catalog. Address Department 13.

MISSISSIPPI GLASS COMPANY
88 Angelica St. • St. Louis 7, Missouri
NEW YORK • CHICAGO • PULLERTON, CALIFORNIA

WORLD'S LARGEST MANUFACTURER OF ROLLED, FIGURED AND WIRED GLASS

For more facts circle 649 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

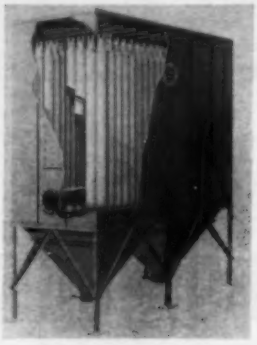
expected to solve lighting problems in areas difficult to light because of restricted space, bulky equipment, excessive heat and brightness and high expense. A companion lamp to company's 30-w lamp in the same size bulb, the new 50-w one is suggested for use where the 30-w is too weak and where 75-w floodlight and spotlight beams are too wide or too concentrated. General Electric Co.

▲ For details, circle 68 on Post Card

Reader Service Cards on pages 301-302 make it easy to get further information on any of these products. Just circle the item numbers of the products you would like to know more about.

FABRIC FILTER for collecting industrial dusts

This filter is available in a fabric envelope type for low gas volume applications, and a tubular type for dust



collection of high gas volumes. Envelopes and tubes come in a range of fabrics including nylon, dacron, orlon and glass. The fabric is cleaned by a shaker mechanism or by reverse gas flow. Bulletin 150 gives specifications. John Wood Co.

▲ For details, circle 69 on Post Card

PERSONAL PAGING SYSTEM can serve 7500 persons

Announced as capable of providing selective voice communications to more than 7500 persons, this radio paging system operates on standard mobile radio VHF frequency bands (25-54 mc and 144-174 mc). It en-

WHEN THE PROBLEM CALLS FOR PAINT THE BEST ANSWER

IS INVARIABLY **Barreled Sunlight** ENGINEERED Paints

FOR A BETTER LOOKING, LONGER LASTING PAINT JOB AT LOWER COST

Rust — and ways and means of fighting it — rate special attention in any well planned preventive maintenance program. And, naturally, *paint* is a first consideration.

Before you select just "any paint" to solve this common industrial problem however, it will pay you to talk with a Barreled Sunlight Engineered Paint representative. His thorough knowledge of the rust inhibiting qualities of various heavy duty primers and finishes — as to how, when and where to apply them — help you make important savings in this critical maintenance area. **This same man** can also help you arrive at the most economical solutions to other painting problems. Call on him now for experienced consultation and a free in-plant demonstration at no obligation.

BARRELED SUNLIGHT PAINT COMPANY
125-J Georgia Avenue, Providence 5, Rhode Island

I want help in selecting the right paint for a specific job in my plant.

☐ Please send me your "Quick Reference Painting Guide" plus your booklet, "How To Reduce Painting Costs."

☐ Please have your representative call me to arrange an appointment at no obligation.

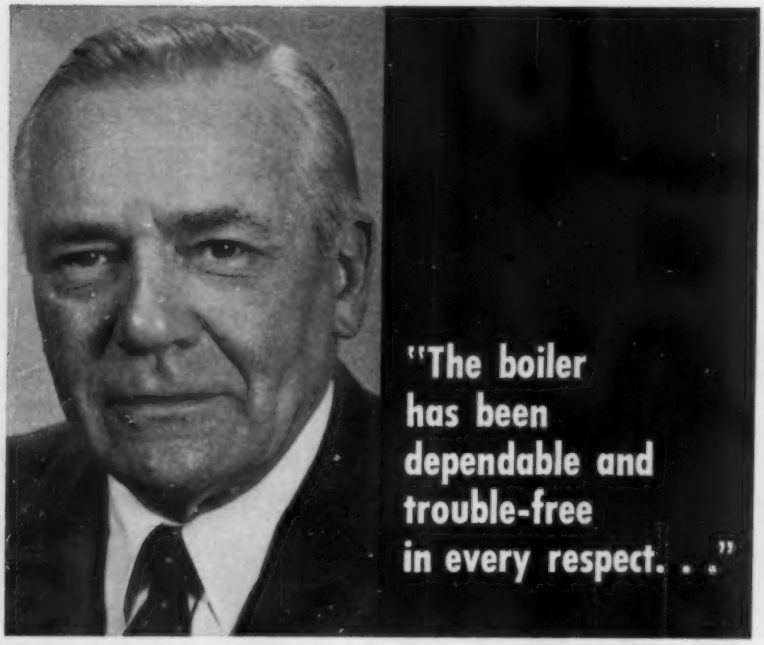
Name.....

Title.....

Company.....

City..... *Zone*..... *State*.....

For more facts circle 650 on Reply Card



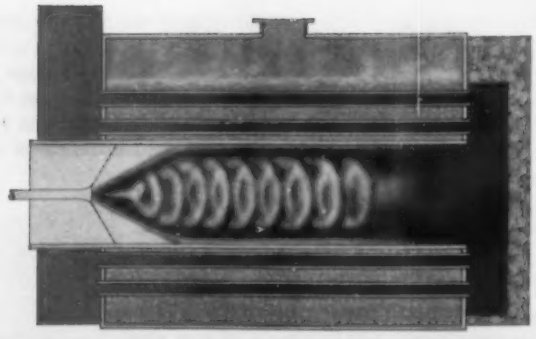
Continental

2-PASS

AUTOMATIC BOILERS

YEAR AFTER YEAR Continental 2-Pass Automatic Boilers continue to add to their reputation for unmatched customer satisfaction. Here's why the Continental 2-Pass Boiler is the one that works for you like no other boiler can:

- **most effective combination of higher heat exchange with maximum radiant heat absorption**
- **faster waterside circulation**
- **less maintenance**
- **low first cost**
- **simple operation**
- **compact, space-saving size**



"SPINNING GAS" TECHNIQUE. *Exclusive firing principle completes combustion in ⅙ of furnace length so that only one return pass of tubes is needed to assure over 80% efficiency with any oil or gas fuel.*

Send for details of new boiler Leasing Plan and Bulletin BE-400.

CONTINENTAL BOILER Division
BOILER ENGINEERING & SUPPLY CO., Inc.
Phoenixville, Pennsylvania
Nationwide Sales and Service in Principal Cities

For more facts circle 651 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

ables one-way communications between a central base station and individuals carrying compact Handie-Talkie Receivers. When an individual is paged, an alerting tone sounds in his receiver. The voice message follows. Private communications are maintained since no other paging receiver is alerted. The transistorized receiver provides 500 milliwatts audio output, enabling reception even in noisy locations. The pager operates from either a rechargeable battery or mercury cells. The 14-oz receiver clips in a pocket or on a belt, accommodates external antenna.

For low capacity systems, a desktop pushbutton control console

(shown) is utilized with a regular two-way radio base station. Up to 90 calls are provided with each console, and four can be used in a system. A separate tone generating console is utilized for higher capacity systems along with two-way radio base station and pushbutton control unit. Stations providing up to 250 w RF power output are available. The station can generate up to 7656 individual calls. Motorola Inc.

▲ For details, circle 70 on Post Card

SEGMENT BENDER is portable, one-man operated

No. 777, a lightweight segment bender for 1¼-to 4-in. aluminum or steel conduit and pipe, weighs 65 lb, exclusive of shoes. It is possible with optional parts to do 90-deg one-shot bending ½ to 2 in, and thin-wall (EMT) bending ¾ to 2 in, manufacturer states. The bender is powered by a two-speed, 10,000 psi hand pump, and can be operated with a power pump for faster operation. The ram develops 27 tons of pressure, and is designed to bend extra-heavy

Descale

boilers, heat exchangers, condensers

easily, more safely with non-fuming Dry Acid Cleaners based on Du Pont Sulfamic Acid

EASIER TO USE

Just scoop the dry acid cleaner from lightweight, disposable drum into make-up tank. Often can be added directly to steam-generating, condensing and similar equipment . . . no elaborate apparatus or specially trained personnel required.

SAFER TO HANDLE

These cleaners are dry, non-fuming powders. No danger of broken carboys, spattered liquids, corrosive fumes with sulfamic-based cleaners.

ECONOMICAL

1 lb. of dry acid cleaner does the job of 1.5 lbs. of hydrochloric acid. You'll save on shipping, handling and storage costs.

LESS CORROSIVE

Sulfamic acid is less corrosive than hydrochloric acid; on brass, 60% less; on steel—70%; copper—85%; aluminum—80%. This low corrosion rate permits use with the equipment's own pump. And, with the proper inhibitor, it can be used safely on galvanized steel.

for more information,
mail coupon for free booklet and names of formulators who offer these compounds

DU PONT
REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

E. I. DU PONT DE NEMOURS & CO. (INC.)
INDUSTRIAL & BIOCHEMICALS DEPARTMENT, N-2539 PE
WILMINGTON 98, DELAWARE

Please send me quick facts bulletin on Dry Acid Cleaners, names of formulators offering cleaners based on Sulfamic acid.

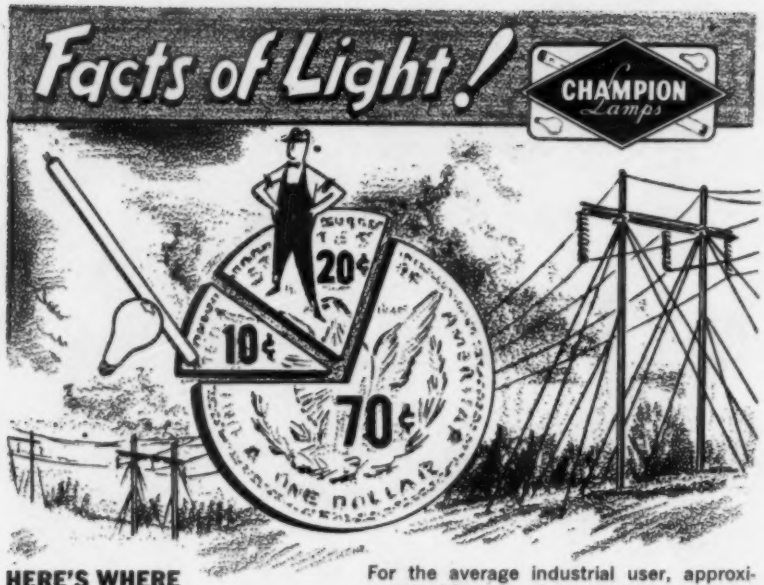
Name_____

Company_____

Address_____

City_____ State_____

For more facts circle 652 on Reply Card



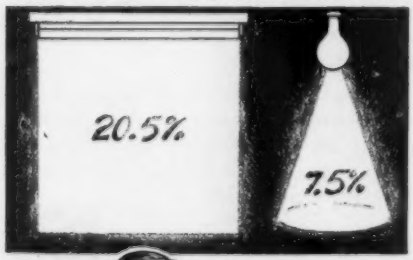
HERE'S WHERE THE MONEY GOES WHEN YOU BUY LIGHT

For the average industrial user, approximately 10 cents of every dollar spent for light goes for lamps; approximately 20 cents goes for maintenance labor; and about 70 cents goes for electric power.

2 100's WON'T DO THE WORK OF 1 200

A 200 watt incandescent lamp produces approximately 3800 lumens. Two 100 watt incandescent lamps produce approximately 3400 lumens — about 10% less light.

WATT FOR WATT, FLUORESCENTS PRODUCE TWICE AS MUCH LIGHT AS INCANDESCENTS



About 7.5% of the electrical energy consumed by a typical 40 watt incandescent lamp is produced as light. In a typical 40 watt fluorescent lamp, the percentage is about 20.5. In both types, the remainder of the electrical energy is heat loss.

OVER 200 INSPECTIONS GUARD CHAMPION LAMP QUALITY

Checks and counter checks at each step of production guard the quality and uniformity of Champion lamps. Result: you get all the light you pay for when you use Champions.

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

For more facts circle 653 on Reply Card

PLANT ENGINEERING EQUIPMENT

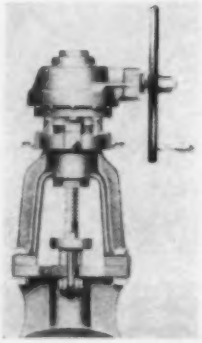
(Begins on page 214)

schedule 80 pipe. Features include: one-piece frame of high-strength aluminum, one set of aluminum pipe supports for all pipe sizes, and quick-locking pins. Greenlee Tool Co.

▲ For details, circle 71 on Post Card

BEVEL GEAR OPERATOR for opening, closing valves

Converto-Gear Operator is designed to provide power-assist in opening and closing iron and steel O.S. & Y. and non-rising stem gate valves having stem diameters of 2½-in. or less. It can be supplied with new valves, or ordered separately and installed in



the field on present Crane valves. Operator uses a bevel gear with a 4.11 to 1 ratio, and unit is adaptable for either pneumatic or electric power wrench operation. Available off the shelf, valve can be converted and operator installed in less than 30 min. company says, while valve is in service. Spiral cut bevel gears are designed to give improved performance and long wear. Operator is adaptable for vertical or horizontal valve operation: Three kits are available for field installation: for O.S. & Y. valves with ball bearing yokes, for O.S. & Y. valves with split yokes and for non-rising stem valves. Crane Co.

▲ For details, circle 72 on Post Card

ELECTRIC POWER UNIT converts hand propelled equipment

Dyna-Drive is a compact power unit created to eliminate manual pushing or dragging of heavy loads. It is adaptable for attachment to hand propelled lift trucks, platform trucks, floor cranes, other mobile equipment, and said to provide smooth starting and rolling. The wheel of the mechanism, designed to carry only the weight of

For more facts circle 654 on Reply Card →

BONUS LIFE
BONUS PROTECTION
from the Boiler Capital of the World

THE TITUSVILLE WTP
FROM THE BOILER CAPITAL OF THE WORLD

• BONUS LIFE means longer life and less refractory maintenance made possible by Titusville's unique WTP design featuring *65% Black Surface Tube Area coverage on rear wall.*

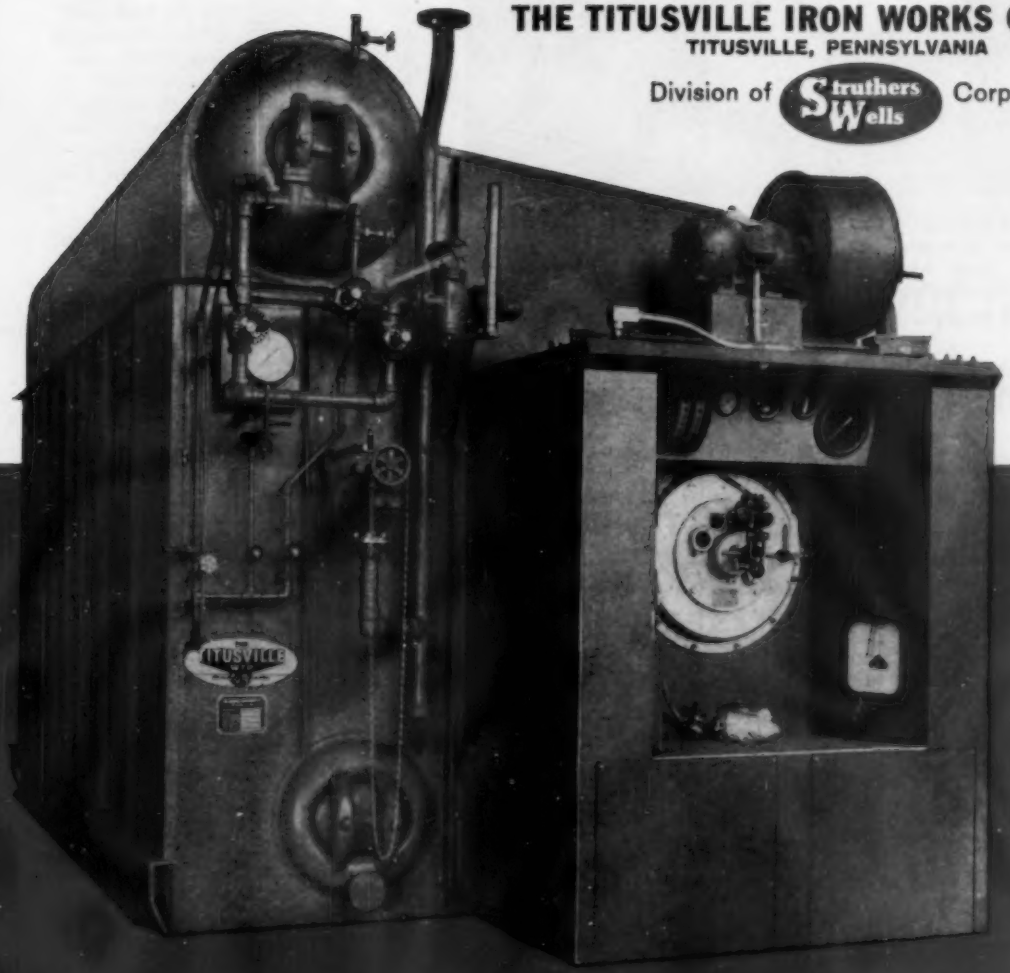
Titusville's increased black surface tube area means less refractory maintenance through longer refractory life (less down-time for replacement) and a faster steamer.

• BONUS PROTECTION provided by Titusville WTP's *double casing design* solves the corrosive product problem.

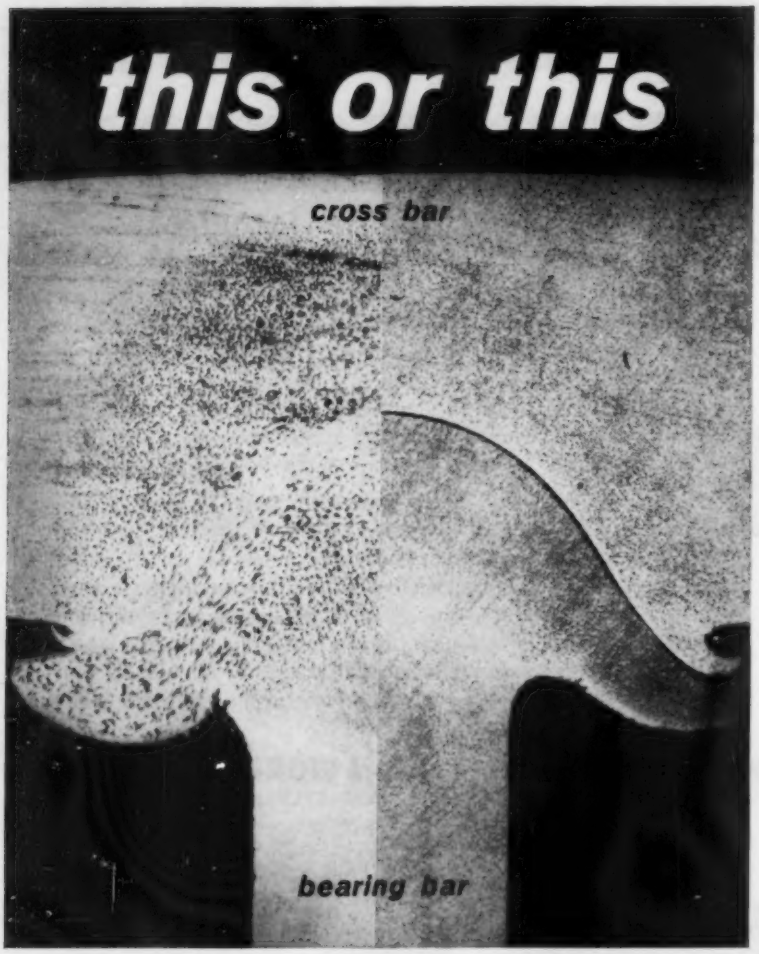
Most water tube steam generators operate intermittently. When dew point is approached at low fire condition, corrosive product can form quickly in single casing boilers.

Titusville WTP's double casing design (with insulation between) reduces temperature differential. Result: formation of corrosive product almost entirely eliminated for many times more casing life.

THE TITUSVILLE IRON WORKS COMPANY
TITUSVILLE, PENNSYLVANIA
Division of Struthers Wells Corporation



For your
BONUS LIFE
and
BONUS
PROTECTION
specify
WTP
from Titusville



This is Dravo Tru-Weld Grating. In this cross section of a cross bar-bearing bar weld, the metal has fused together. There are no gaps to admit moisture or weaken the joint. It cannot come apart.

Here fusion of metals is incomplete. There is a noticeable gap between bearing bar and cross bar, an open invitation to internal corrosion which can weaken the joint and add to maintenance costs.

which weld for your grating?

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more.*

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating, call the Dravo representative in your area, or write DRAVO CORPORATION, PITTSBURGH 25, PA.

DRAVO
CORPORATION
For more facts circle 655 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

the propulsion unit itself, rides up and down freely, compensating for floor irregularities and as well as maintaining constant traction between wheel and surface. Push buttons in the handle's center provide for finger tip

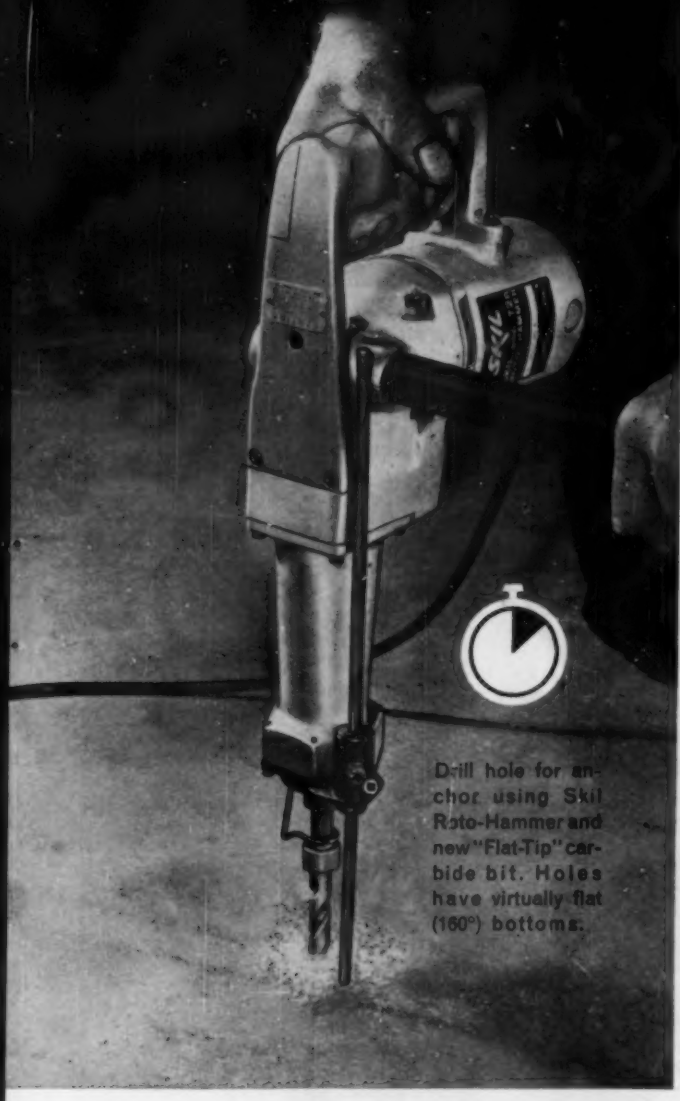
control of forward and backward acceleration and braking. Dyna-Drive is available in 3000- or 8000-lb capacities. The former has a 12-v d-c heavy-duty motor, 10-by-3 in. driving wheel, and a handle control mechanically operated brake, fluid drive or centrifugal clutch. The larger capacity unit has a 10-by-4 in. driving wheel and an automatic deadman brake. Colson Corp.

For details, circle 73 on Post Card

ADAPTERS convert manual valves to automatics

Manually operated process and control valves may be economically converted to automatic operation with this valve adapter, company states. The unit works with present piping and valve bodies so that lines in over-

heads, walls, floors and equipment need not be disturbed. Installation is by removing stem and bonnet of the old valve and screwing an adapter into place instead. The adapter is



Drill hole for anchor using Skil Roto-Hammer and new "Flat-Tip" carbide bit. Holes have virtually flat (160°) bottoms.

Clean out hole, insert expander plug in anchor and drive home with claw hammer or mallet. Total elapsed time: 25 seconds.

New Skil method sets anchors* 400% faster at 1/3 the cost...

using Model 726 Roto-Hammer and new Skil "Flat-Tip" Carbide Bits

COMPARISON TEST Based on setting 1000 self-drilling anchors for ⅜" bolts in 9/16" diam. holes (labor at $3.00 per hr.)					
	NEW SKIL METHOD	1 No. 23536 Flat-Tip Bit used	6.80 hours labor required	$37.40 total cost (labor and bit)	3.7¢ cost per anchor setting
	CONVENTIONAL METHOD	1 chuck wrench needed	28.33 hours of labor required	$94.52 total cost (labor and chuck wrench)	9.4¢ cost per anchor setting

NOTE: Cost of anchors (same for both tests) not included.

Ask your Skil distributor for a demonstration. Look under "Tools—Electric" in the Yellow Pages. Or write Skil Corporation, Dept. 120J, 5033 Elston Avenue, Chicago 30, Illinois. In Canada: Skiltools Limited, Trenton, Ontario.

*Self-drilling and expansion type shields, also new types about to be announced.

Automatic Power Rotation. Model 726 drills holes without tiresome hand turning of star drills. Low maintenance. No springs to break.

SKIL ...AND SKILSAW POWER TOOLS

For more facts circle 656 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

then linked by wiring or hydraulic tubing to a conveniently located automatic switch or timer. Where more than one valve is involved, control maybe integrated in a suitable multiple station controller which will actuate each valve independently according to its prescribed on-off cycle. Model 28E (electrically operated) and Model 28H (hydraulically operated) are available for converting most standard globe valves in present use. Febco, Inc.

▲ For details, circle 74 on Post Card

VACUUM HOIST LIFTER lifts up to 100 lb

Although developed for lifting car hoods and trunks in a horizontal position and stacking them vertically, this versatile vacuum hoist attachment can be adapted to similar problems involving horizontal lifting and vertical stacking of lightweight, nonporous material. It is made of aluminum

tubing and weighs only 40 lb and has a lifting capacity of 100 lb. Construction incorporates four Neoprene pads. The attachment may be used in conjunction with company's Powerpac and existing hoisting facilities. Vac-U-Lift Co.

▲ For details, circle 75 on Post Card

The coupling that's

Tougher... Lighter... Smaller

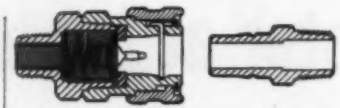
handles more air...with minimum pressure drop

– and gives you all these other advantages –

Has fewer parts. Locking ring provides positive lock... tight fit ... minimum wear. Equipped with automatic sleeve lock.

Handles any job in your shop using ¾" to ⅛" connections — from the air line to the air tool.

All Series 2-RL Sockets and Plugs are interchangeable — likewise all Series 3-RL Sockets and Plugs. Eliminates any need for various size couplings in hook-up — makes it easy to keep stock parts in balance — holds inventories to a minimum.



Instant Automatic Flow or Shut-Off

Write for the Hansen Catalog

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings — including Special Service Couplings for LP-Gas, Steam, Oxygen, Acetylene, etc.

Representatives in Principal Cities — See Yellow Pages

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

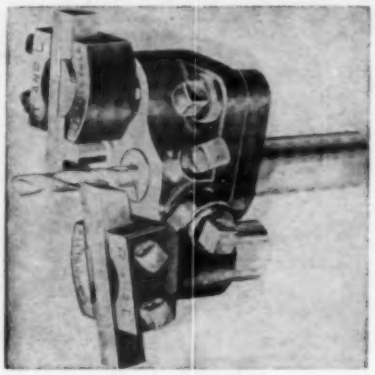
THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 35, OHIO

For more facts circle 657 on Reply Card

TURNING TOOL for turret lathe and screw machine

This versatile tool duplicates operations of 14 separate tools, it is announced. It can be changed from a right- to left-hand tool in seconds, says manufacturer, and used as either right- or left-hand balancing turning tool, centering facing or knee tools, as a backrest, roller box floating drill holder or pointing tool. Setting for various operations are simplified. Operations performed include drilling and chamfering, turning and centering, turning shoulders concentric with stock diameter, turning and forming special spaces on ends of parts while drilling or reaming, turning two diameters while drilling or reaming, turning and chamfering two corners while facing end of part along with drilling or reaming etc. R and L Tools.

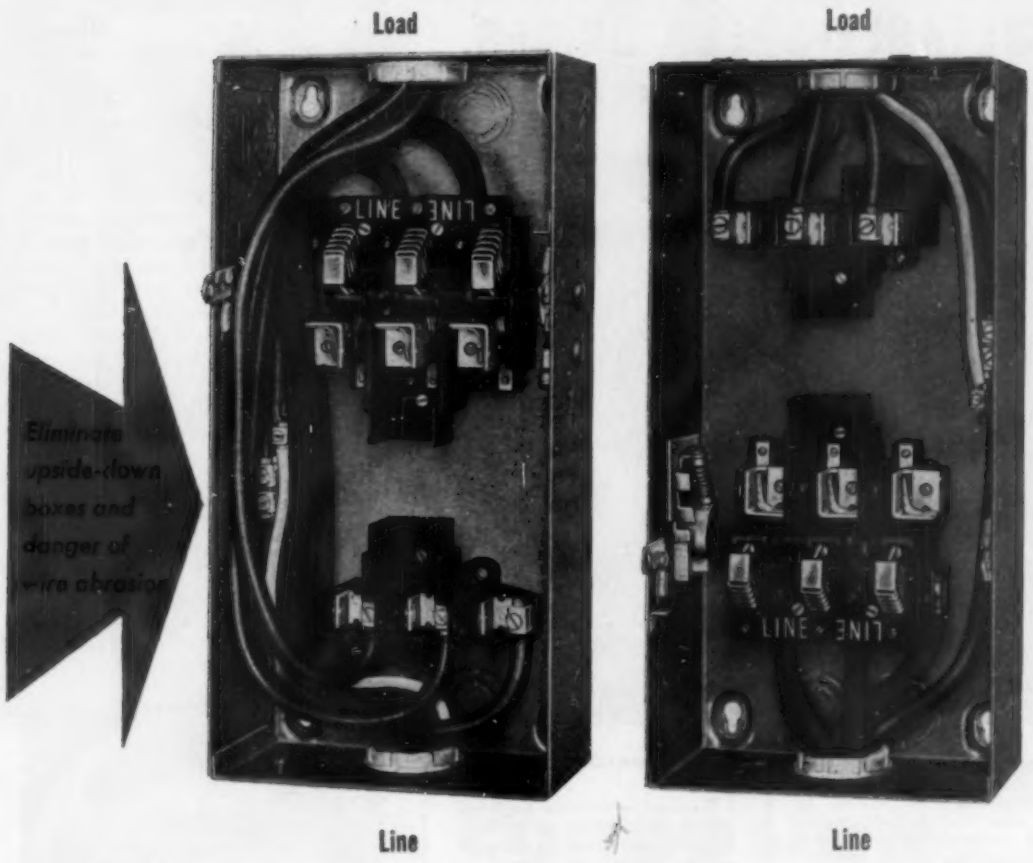


▲ For details, circle 76 on Post Card

FLUORESCENT LAMP gives more light for the money

This fluorescent lamp is announced as providing 15 per cent more light than standard 40-w cool white lamps, and 36 per cent more than daylight type lamps. Producing 3200 lumens, compared to 2800 for conventional 40-w fluorescent lamps, the new product also offers excellent light

Save up to $30 on cable cost with new G-E reversible-wiring safety switches



Old way wastes wire, work and money. Looped cable inside box presents danger of wire abrasion. None of this is necessary when you use new General Electric reversible-wiring safety switches, 100-amp and above.

New G-E way eliminates danger of wire abrasion, inconvenience of upside-down boxes. ON-OFF indication remains unchanged. Available with line lugs factory-installed at bottom, or for field installation.

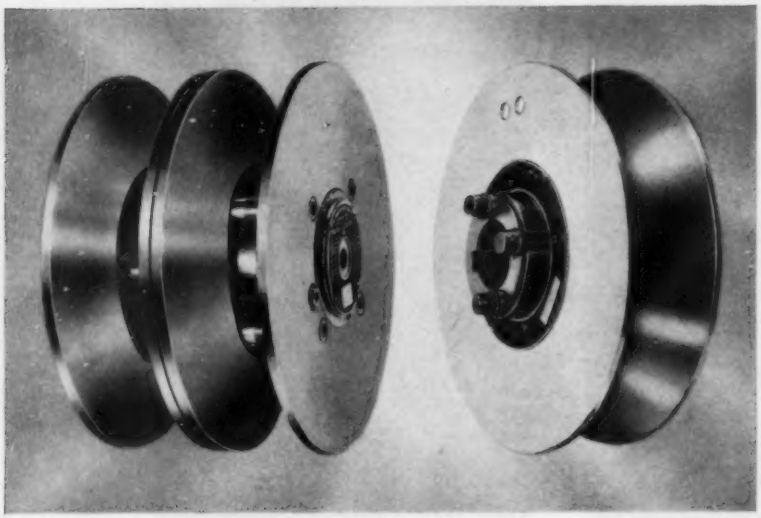
Switch Rating	Conductor Size	Amount Saved Per Switch Installed*		Length of Wire Saved (In Feet)	
		2-Pole	3-Pole	2-Pole	3-Pole
100 AMP	2	$ .91	$ 1.36	5	8
200 AMP	3/0	3.73	5.60	9	14
400 AMP/240 VOLT	500 MCM	12.56	18.90	11	16
400 AMP/600 VOLT	500 MCM	13.74	20.60	12	17½
600 AMP/240 VOLT	(2) 350 MCM	18.70	28.10	22	33½
600 AMP/600 VOLT	(2) 350 MCM	20.40	30.60	24	36½

*Based on approximate contractor prices for Type RHW copper building wire.

GENERAL ELECTRIC

Circuit Protective Devices Dept., Plainville, Conn.
For more facts circle 658 on Reply Card

NOW AP OFFERS THE MOST COMPLETE LINE OF WIDE-RANGE ADJUSTABLE-SPEED DRIVES FROM STOCK



Single groove drives in "Q", "R", and "W" cross-section transmit up to 20 hp.
Double groove drives in "R" cross-section transmit up to 30 hp.

Order from 7 sizes and 4 models of AP Wide-Range Adjustable-Speed Drives. Single groove drives in "Q", "R", and "W" belt cross-section width transmit up to 20 hp. And double-groove drives in "R" belt cross-section widths deliver up to 30 hp.

Previously made on special order for textile machinery manufacturers, AP 2-R Groove Adjustable-Speed Drives are now being made for Stock. Intended for use on machines where a heavy duty, dependable, economical adjustable-speed drive is needed, they are ideal for replacement of existing overloaded drives—and new installations—where increased capacities are required.

AP Wide-Range Adjustable-Speed Drives are the economical, compact and positive form of speed control. Furnishing quiet, accurate adjustment (up to 2:1), they insure proper drive speed for all applications.

FEATURES:

1 Exclusive double-tapered hub locks flanges securely—permits stepless, accurate speed adjustment. Small or large adjustments are precise and permanent, no freezing.

2 Precisely machined and dynamically balanced, all sheaves are strong, quiet running, long-lasting and trouble-free.

3 Simultaneously moving flanges insure correct belt alignment at all times.

4 Companion Sheaves feature Q-D Bushings. Easily installed or removed, they grip shaft firmly.

Your AP Distributor will tell you why more mill men are specifying AP Adjustable-Speed Drives. See him! His experience and engineering know-how will prove that it pays for you to standardize on AP.

THE AMERICAN PULLEY COMPANY
4200 WISSAHICKON AVENUE • PHILADELPHIA 29, PA.
A division of VAN NORMAN INDUSTRIES INC.

2652

For more facts circle 659 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

maintenance characteristics, according to manufacturer. It is designed to provide greater economy in lighting costs and suggested for applications where high light output at low cost is more important than critical color rendition.

High efficiency of the lamps is attributed to use of special green phosphors, balanced by color improving phosphors rich in red to provide an eighth shade of white fluorescent light. This color is said to produce a cool, comfortable atmosphere, ideal for seeing tasks with good rendition obtained on all colors as well as the complexion. Made in universal preheat rapid start design, the high efficiency fits present fixtures and ballasts; it lists for around $1.30. It is also available in the 96-in. slimline design at around $3.30. Westinghouse Electric Corp.

▲ For details, circle 77 on Post Card

LOAD CALCULATOR determines man-hour requirements

For simplifying the translation of production quantities and rates into shop loads, the Machine Load Calcu-

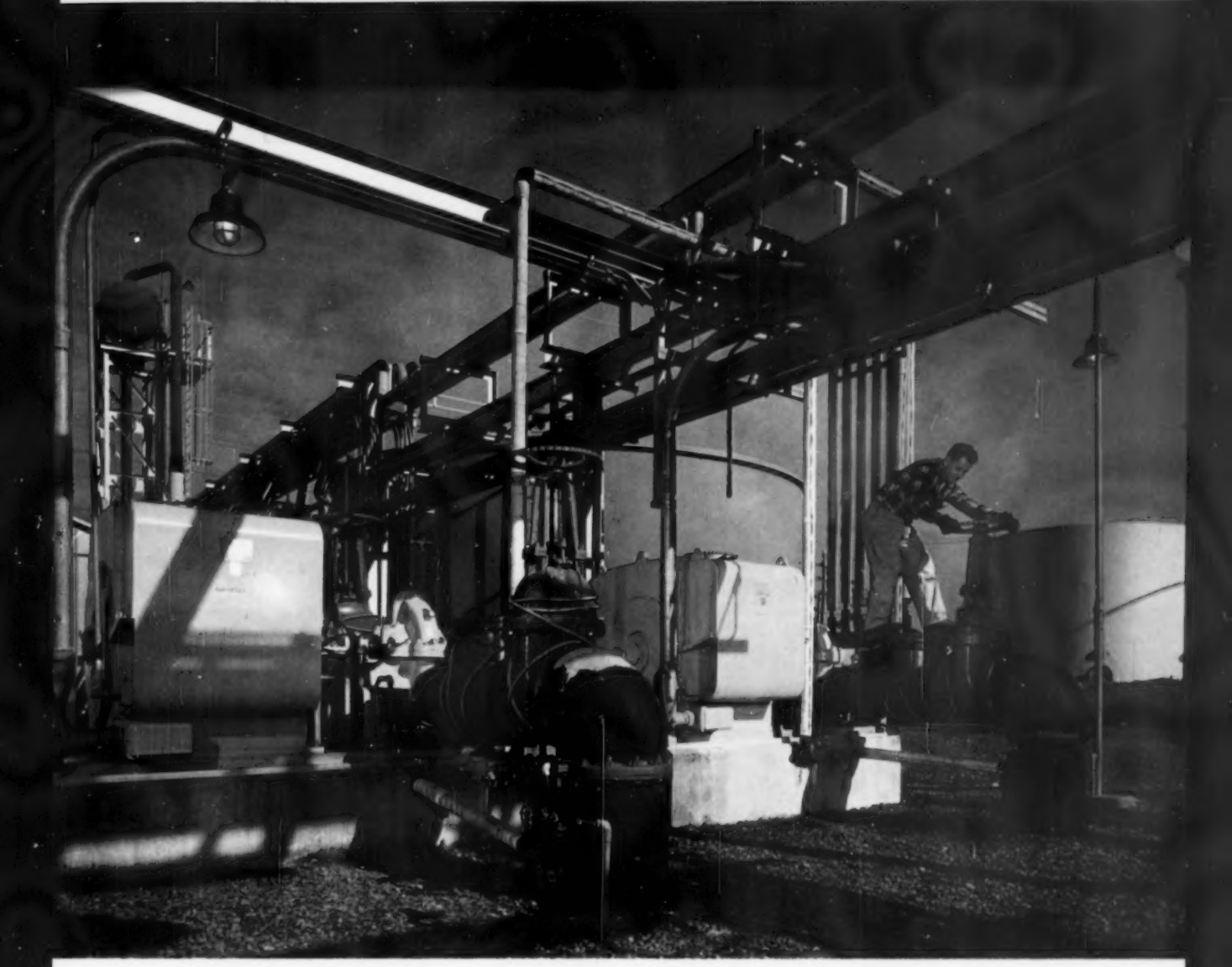
lator uses regular shop order quantities and operation standards. It shows correct production hours either for a single operation or for a series of operations—with one setting of its two discs. Of vinyl plastic, this 6-in. diam calculator costs under $8.00. Van D. Mark.

▲ For details, circle 78 on Post Card

METAL SLICER utilizes thin cutting wheel

Claimed capable of slicing costly and rare metals into wafers so thin that 100 can be stacked to the inch, the

For more facts circle 660 on Reply Card →



CONTROL CORROSION

Severe weathering, critical chemical exposures even at elevated temperatures, and many other corrosion problems can be controlled by a Truscon system specifically engineered for the job. Maximum protection at the lowest cost per square foot per year is the prime consideration of every Truscon recommendation.

When you consult Truscon you get a written specification for proper surface preparation and painting, plus assistance in application and inspection methods. Interior or exterior surfaces, metal or concrete, machinery, buildings, bridges, or tanks, can all be protected by a Truscon coating system. Call the branch nearest you or write Truscon Laboratories for specific information.

TRUSCON *Laboratories*

Industrial Maintenance Division of
Devoe & Raynolds Co., Inc.
Detroit 11, Michigan

DARCOVA PUMCUPS

now available with

100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

Darcova 45° Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

Write for helpful data Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.

Williamsport 14, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

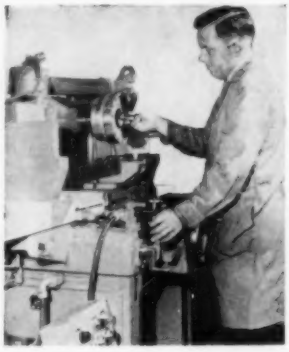
TRADE MARK
PUMCUPS

For more facts circle 661 on Reply Card

PLANT ENGINEERING EQUIPMENT

(Begins on page 214)

I/D Micro-Slicer uses a thin cutting wheel with an open center. Circling the inside opening is a diamond cutting edge. The ingot of metal to be cut is positioned through the inner opening in the wheel. Slicing is done automatically. Cutting wheels are only

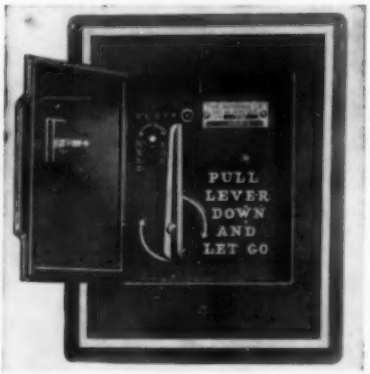


0.006 and 0.010 in. thick. (Cutting surfaces two to three times as thick are generally used for slicing with the outside edge.) The result, according to manufacturer, is a 40 to 50 reduction in material lost in cutting. The DoAll Co.

▲ For a copy, circle 79 on Post Card

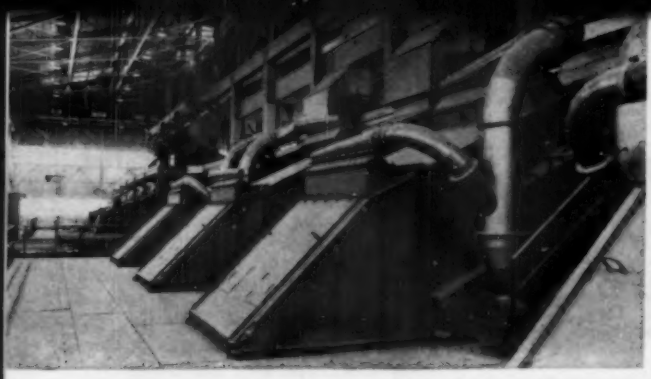
FIRE ALARM STATION with a slimmed down profile

In designing this fire alarm station, manufacturer has taken the mechanism out of the hall and put it in the wall, reducing box projection beyond

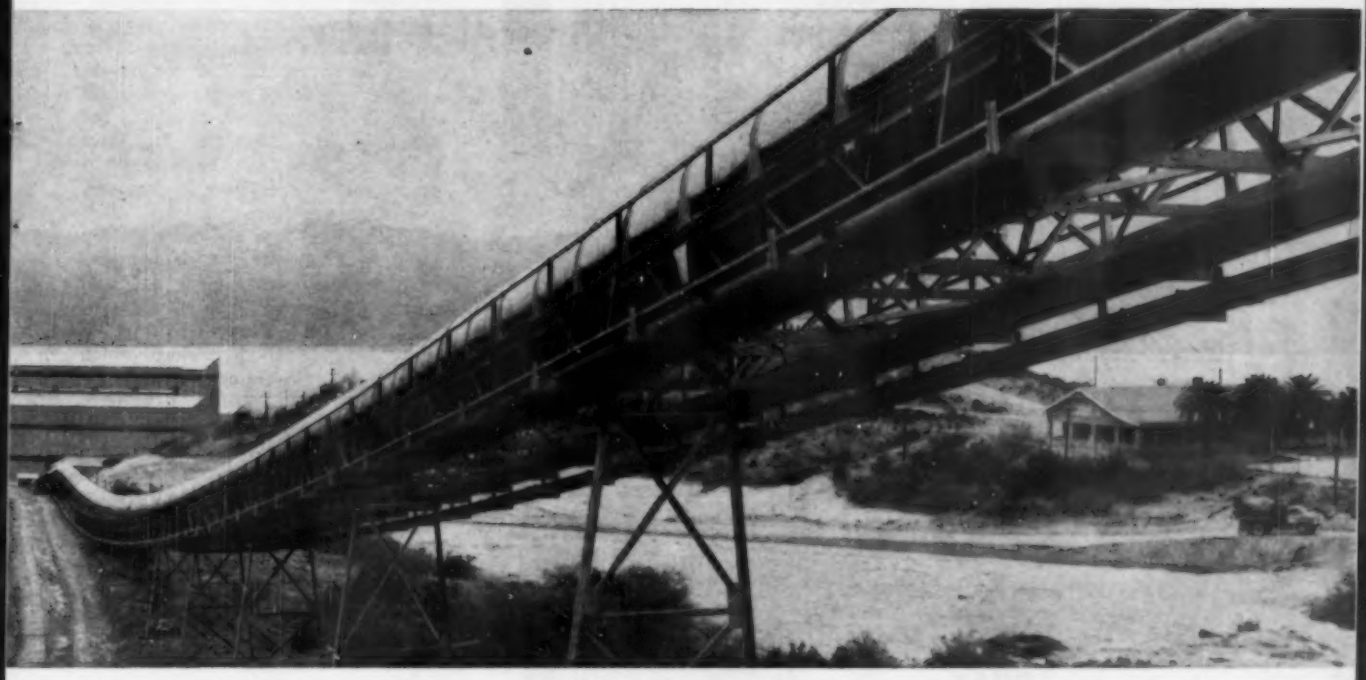


wall surface to a mere ¾ in. Built to be easily seen despite its streamlined design, the station is not only slender but presents a smaller face plate. Alarm box is for use with any coded fire alarm system. The Autocall Co.

▲ For a copy, circle 80 on Post Card



Designer and Constructor: Stearns-Roger Mfg. Co., Denver, Colorado.



Kennecott selects Steel for its New Arizona Expansion Program

American Bridge fabricated and erected this Fine Ore Crushing Building, Fine Ore Storage Building, and 1,920-ft. conveyor support structure for Kennecott Copper Corporation. This new building expansion at Kennecott's Ray Mines Division in Arizona required 1,950 tons of structural steel, and all connections were bolted or welded at the job site. ☐ Why Structural Steel? It saves time and money . . . it's easy to fabricate . . . easy to work with. Designers and contractors are more familiar with steel than other structural materials . . . the job's done right. And no other material can match the strength, durability, dependability, and economy of structural steel. ☐ American Bridge is experienced in all types of structural steel fabrication and construction. For more information, contact any of our offices listed below.

USS is a registered trademark

This mark tells you a product is made of modern, dependable Steel.

General Offices: 525 William Penn Place, Pittsburgh, Pa.
Contracting Offices in: Ambridge • Atlanta • Baltimore • Birmingham • Boston Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Elmira • Gary Harrisburg, Pa. • Houston • Los Angeles • Memphis • Minneapolis • New York Orange, Texas • Philadelphia • Pittsburgh • Portland, Ore. • Roanoke • St. Louis San Francisco • Trenton • United States Steel Export Company, New York

American Bridge Division of United States Steel

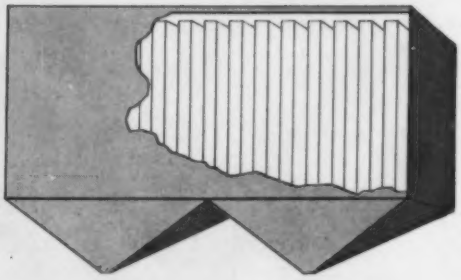
USS

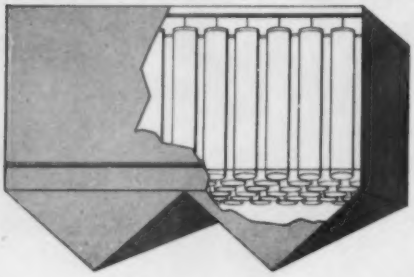
For more facts circle 662 on Reply Card

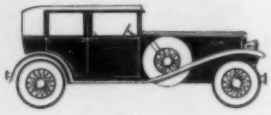
SINCE 1879 SLY

SLY DUST FILTERS
For Maximum
COMPACTNESS

1900's
SLY DUST ARRESTER
47% less filtering area per cubic foot of filter.

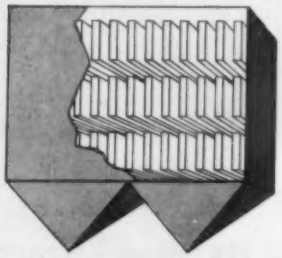






1930's
SLY TUBE-TYPE FILTER
37% less filtering area per cubic foot of filter.

TODAY
NEW SLY "ROLL-CLEAN" DYNACLONE®
Most filtering area per cubic foot of filter.



SLY DUST FILTERS PROVIDE 20 TO 40% MORE CLOTH IN A GIVEN SPACE THAN ANY OTHER DUST FILTER.

The new "Roll-Clean" Dynaclone gives: Continuous cleaning, constant suction and complete accessibility in the least possible space.

Space saved with the Dynaclone means: Lower installation costs, lower building costs, simplified piping and ductwork.

Only the Dynaclone furnishes: A single exhaust fan that does the entire job, providing *both* suction for dust collection *and* air for bag cleaning. No auxiliary blowers required.

New "Resist-O-Wear" bags in the Dynaclone offer: 200 to 300% more bag life, easier bag changing, simplicity of construction, and *job-proved* ruggedness.

More than 40,000 Sly Dust Filters in operation, including over 1,000 Sly Dynaclones, prove their advanced design. See for yourself . . .

SEND FOR 36-PAGE CATALOG 104

THE W. W. SLY MANUFACTURING CO.

4600 Train Avenue • Cleveland 1, Ohio • Offices in Principal Cities • Overseas Licensee: Andrew Air Conditioning Ltd., London S. W. 1, England

For more facts circle 663 on Reply Card

INDUSTRIAL FILMS

New Film Library

AN INDUSTRIAL EDUCATION Film Library offering industry and government original audio-visual aids for reducing costs, increasing productivity and improving quality or performance, is being established in Princeton, N. J.

The library's films provide a systematic method for keeping abreast of the latest developments and techniques for more efficient and economical operations. Produced under the direction of authorities in their fields, the films will be helpful to executives, supervisors, engineers and other top personnel.

Audio-visual aids are often needed to help "sell" the cost reducing techniques to management and employees. Training directors will now have access to a collection of specifically designed motion pictures which can be used in training and indoctrination program. Prints of the films are for rent and sale.

Films now in the library, or planned for production include "The Concept and Principles of Functional Drafting," "The Principles and Application of Work Sampling," "Locating and Developing Creativity in the Organization," "Inventory Control," Planning More Profitable Plant and Office Layouts," and "Cutting 'Must' Reading Time in Half."

For further information, write to Industrial Education Film Library, 3 Palmer Square, Princeton, N. J.

Techniques for Cost Reduction

A NEW INDUSTRIAL motion picture on work sampling, especially designed to provide industrial and business organizations with an economical, convenient method of familiarizing management and employees with this cost-reducing technique, is now being distributed in the United States and abroad.

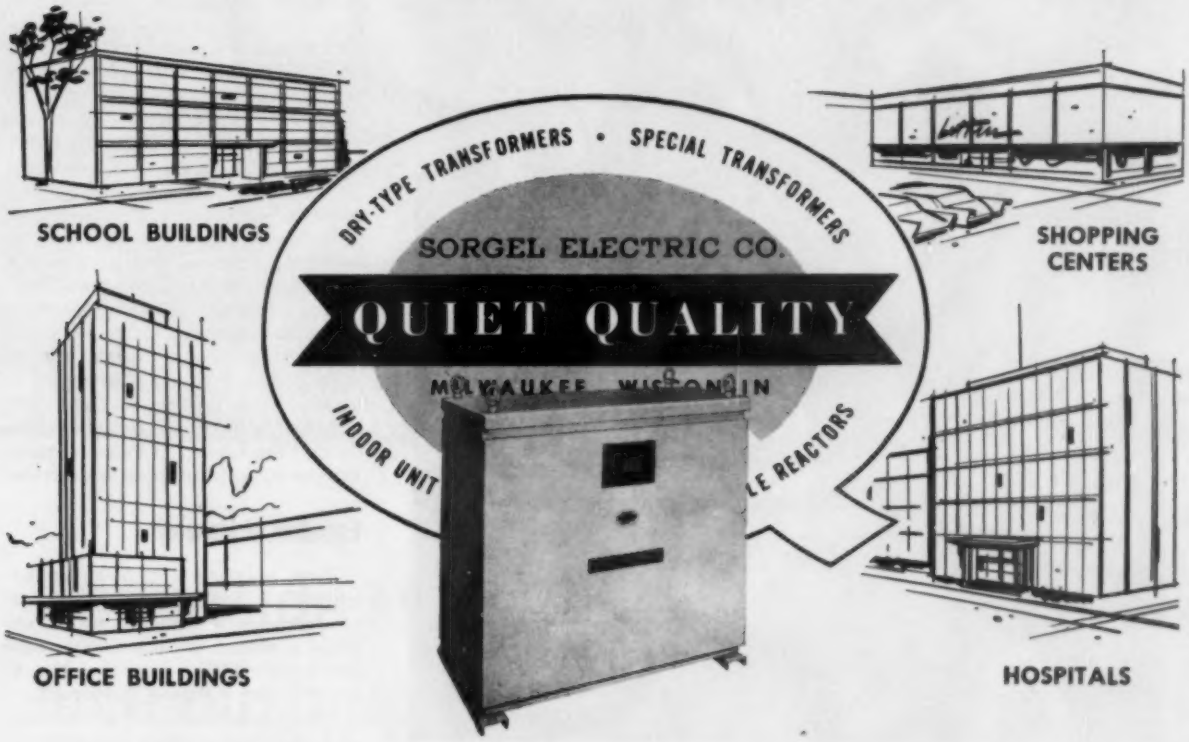
Entitled "The Principles and Application of Work Sampling," it was written under the direction of Wallace J. Richardson, Professor of Industrial Engineering, Lehigh University.

The film gives a sound understanding of the technique to everyone concerned with cost reduction programs . . . top management personnel responsible for approving them, department heads who implement them, union officials who must be "sold" on them, and employees involved in them.

After demonstrating the need for

SORGEL'S SPECIALIZATION

assures Quiet Quality dry-type transformer performance that's the finest in the industry



Since 1916 the principal products at Sorgel Electric Company have been dry-type transformers. Because of this long-time pioneering, specialization and experienced engineering, Sorgel customers are assured of continuous, more dependable transformer performance.

The Quiet Quality of Sorgel dry-type transformers provide the highest efficiency, which reduces operating costs. Sorgel specialization assures a product that requires little or no maintenance, and a design that's easy, more economical to install.

Imaginative progress has been, and is being, made every day at Sorgel. In all forms of modern electrical distribution the Sorgel product is your best buy in stepping down higher distribution voltage to utilization voltage for institutional, commercial and industrial buildings. Look for the Sorgel mark, and when you find it, you'll know this electrical installation was the first choice of a quality-conscious Consulting Engineer, Plant Engineer, Contractor or End-user who wanted to assure dependable, uninterrupted electrical distribution.

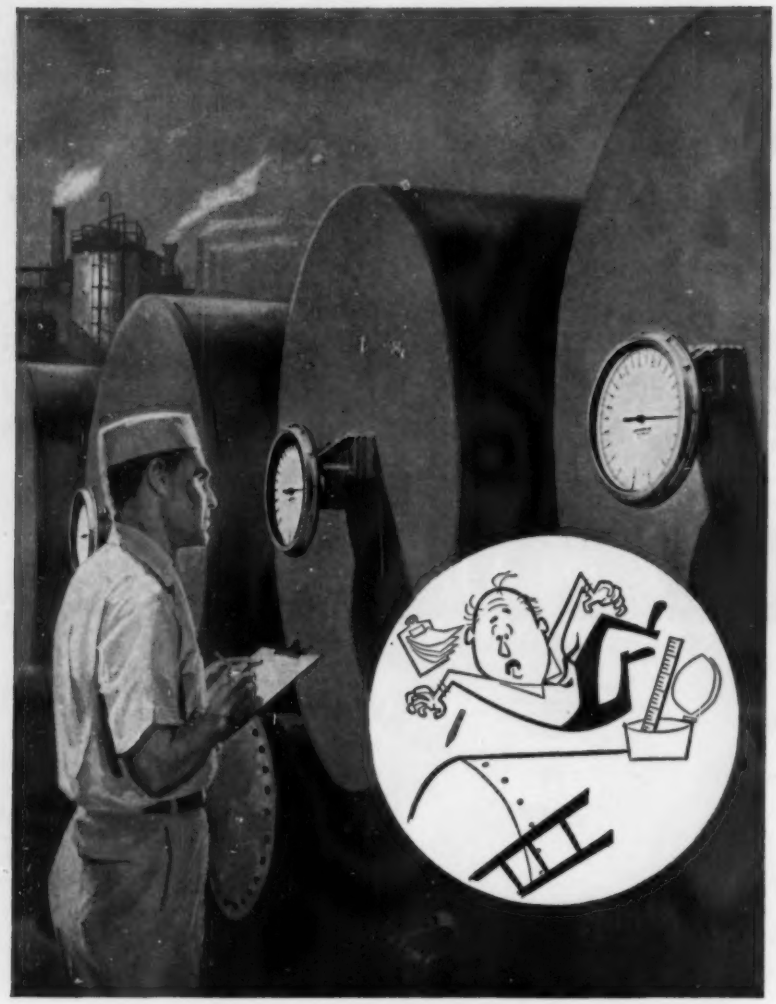
Complete Line for Every Purpose up to 10,000 Kva, up to 15,000 Volts, Including Special Transformers and Saturable Reactors

SORGEL ELECTRIC COMPANY

841 West National Ave., Milwaukee 4, Wisconsin

Sales engineers in principal cities. Consult the classified section of your telephone directory or communicate with our factory.

For more facts circle 664 on Reply Card



Reading liquid levels got you out on a limb?

Not if an easy-to-read Liquidometer Gauge is used to indicate exact levels at a glance. It's as simple as telling time... ends potentially dangerous dip-sticking.

Liquidometer Gauges enable one man to read liquid levels safely and precisely—keeping a continuous, right-at-hand inventory – without risking life and limb.

Take the hazards out of liquid measurement—save time, too—by installing reliable Liquidometer Gauges. There is a type available for practically every liquid measuring application.

For complete details, write

LIQUIDOMETER INSTRUMENTS

THE LIQUIDOMETER CORP.

Dept. B, Long Island City 1, New York

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INDUSTRIAL FILMS

work measurement, Professor Richardson shows in the film how work sampling studies are conducted and demonstrates some of the many applications of this new technique, such as determining which operations should be included in cost-reduction programs, applying results to cost control and cost accounting, and developing realistic estimates of manpower requirements.

The film is a part of a series designed to provide industry with audio-visual aids on successful techniques for reducing costs, increasing productivity, and improving quality of performance. This subject was produced as a result of continuing studies of specific industry needs conducted by the Industrial Education Institute at seminars held throughout the country. It is designed to supplement existing company training programs, or to form the foundation for a new program. Write to the Industrial Education Film Library, 3 Palmer Square, Princeton, N. J. for more information.

Esthetics of Masonry

THE MASONRY INDUSTRY has launched a new venture in the field of architectural esthetics which employs a motion picture film, a book and a high fidelity recording, the Allied Masonry Council announced.

"Man and Masonry," is the result of a year-long research project on the esthetic qualities of masonry made under the direction of Bernd Foerster, Assistant Professor of Architecture at Rensselaer Polytechnic Institute.

Professor Foerster's study included the gathering of many unusual photographs from all over the world. In addition to their own individual interest, these photographs of both obscure and famous structures have an unusual relationship to each other. They were developed into a motion picture film which examines masonry through scale, nature, form, light, screens, pattern, texture, sculpture and emotion.

At the same time that the film was being produced, a "Man and Masonry" book, employing the same photographs, was edited.

The masonry industry plans to show the film at a series of meetings for architects around the country. The "Man and Masonry" book and the symphonic record are being distributed to architects by members of the masonry industry. For further information write to Standard Clay Products Institute, 1520 18th St., N.W., Washington 6, D.C.

For more facts circle 666 on Reply Card ⟶

Right, PPG insulation is easily cut to size on the job. Left, Foreman Charles W. Booth, of Acheson Sheet Metal Company, supervises installation of ductwork. PPG Neoprene-coated Duct Liner meets all requirements of NBFU Bulletins No. 90-A and 90-B for ducts, and bears the label of Underwriters' Laboratories, Inc.

The inside story on a hush-up job in Tampa

(with PPG Fiber Glass Insulation, of course!)

It will be quiet, as well as comfortable around the new State Agency Building at Tampa, Florida, because PPG Fiber Glass Insulation has been installed in the ductwork of the heating and air conditioning system.

Job foreman Charles W. Booth of Acheson Sheet Metal Company, Jacksonville, installers of the ductwork, reports that the long life-expectancy of PPG Neoprene-coated Fiber Glass is of great importance in the choice of this insulation, because of the difficulty of replacement in a duct system.

It's what's inside that counts!

Mr. Booth says that PPG Insulation has extraordinary sound-deadening qualities which eliminate fan noise, has excellent thermal-barrier characteristics, and low resistance to air flow. In addition to ease of handling and installation, it will not be affected by humidity, won't swell, rot or decay . . . very important in Tampa-types of climates!

Get best results with PPG

Available in a range of sizes, densities, and facings to meet any insulation specification. For more information, contact your nearest Fiber Glass Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Fort Wayne, Houston, Jacksonville, Kansas City, Los Angeles, Louisville, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Seattle and Washington

FIBER PPG GLASS

PITTSBURGH PLATE GLASS COMPANY

Industrial Lighting

(Continued from page 179)

quire very little comment. In borderline decisions between the use of incandescent and fluorescent, two questions may be asked: "Are the hours use long enough so that the lower operating cost will offset the higher first cost of fluorescent?" and "Is the greater diffusion provided by the 'line' source, fluorescent, a desirable feature?"

End darkening of fluorescent lamps in general is of three types. Fairly dense blackening, starting at the base and extending along the lamp for two or three inches generally indicates that the lamp is at or near the end of its life. A dark spot is not an indication that the lamp is near the end of its life. It is condensed mercury, which sometimes appears on new lamps but usually evaporates after the lamp has been lighted for a while. Mercury may condense on the bulb at other times, where one part of the bulb is cooler than the rest. Streaks or spots sometimes occur when louvers are close to lamps.

When the cathodes of a preheat lamp flash on and off, but the lamp does not start, the lamp may be at the end of its life, or the starter may have failed. If the lamp does not show enough end blackening to indicate end of life, the starter should be checked. A manual-reset starter may merely need to have the reset button pushed.

If a rapid start or an instant start lamp fails to operate and is apparently not near the end of life, look for poor contact in the lampholders. **End Part II**

Unit Heater Maintenance

(Continued from page 129)

heaters attached while another guides the eye bolts of the heater onto the hooks on the crosspiece. This has certainly simplified the job and eliminated the waste of manpower.

The piping has been redesigned, too, to allow for flushing the coil section of the heater. A dripleg is installed on the discharge side of the heater to collect scale and rust. Simply disconnect a union on the supply end and one on the discharge side of the heater, and it is ready to be removed.

Electrical connection at the motor is made with a flexible cord. By removing three screws from the fan guard which supports the motor, it can be hung to one side without a motor disconnect. This makes it possible to steam-clean the radiator in place.

The latest innovation is the use of Teflon tape on pipe threads. Leaks have been virtually eliminated.

This streamlined standard approach to unit heater installation and maintenance is now reducing Monsanto's cost over $5000 a year at this plant alone. **End**

. . . in the chemical treatment of your WATER—STEAM—FUEL. For over 70 years Western's special formulas and individual technical service have been controlling scale, corrosion, foaming, algae, sludge, soot, and related operating problems. Ask for the brochures that apply to your own needs.

WESTERN CHEMICAL COMPANY

714 Washington St., Kansas City 5, Mo.

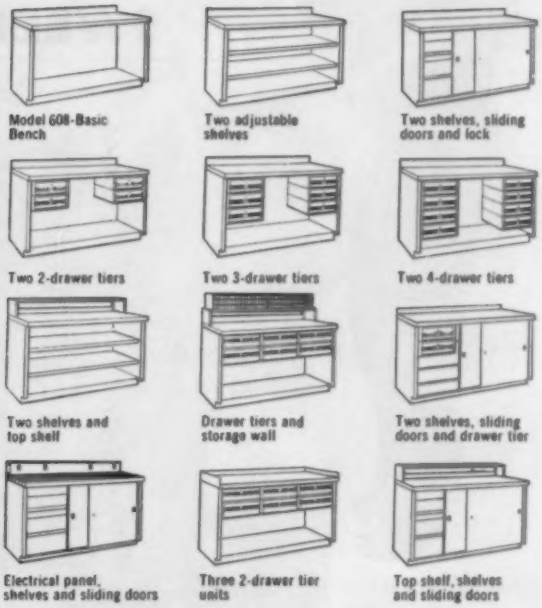
For more facts circle 667 on Reply Card

Tear Sheets, Anyone?

Readers interested in obtaining tear sheets of articles should write to the Editor, Plant Engineering, 308 East James St., Barrington, Ill., or use the postpaid card elsewhere in this issue.

HALLOWELL

CABINET BENCHES



Model 608-Basic Bench
Two adjustable shelves
Two shelves, sliding doors and lock
Two 2-drawer tiers
Two 3-drawer tiers
Two 4-drawer tiers
Two shelves and top shelf
Drawer tiers and storage wall
Two shelves, sliding doors and drawer tier
Electrical panel, shelves and sliding doors
Three 2-drawer tier units
Top shelf, shelves and sliding doors

There is a standard HALLOWELL Cabinet Bench for every job. Drawers, doors, electrical panels or test panels, shelves and other interchangeable accessories give you what you need *now*—yet enable you to rearrange or add as work requirements change. Built to last indefinitely. Ask your HALLOWELL distributor for full information, or mail coupon below.

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Jenkintown 26, Pa.

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where reliability replaces probability

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Another TENNANT First!

NEW walk-behind ELECTRIC SWEEPER!

NO FUMES, NO ODORS with the new TENNANT Model 40-E Electric Sweeper! Silent, safe and sanitary; assures an ULTRA-CLEAN sweeping job!

First of its kind, the new TENNANT Model 40-E *Electric* Sweeper is in a class by itself for ultra-clean sweeping and sanitary performance!

Compact. Just 33" wide, this new self-propelled, dual-battery machine is especially made for vacuumized sweeping of congested areas where standards of cleanliness are critical.

Economical. Replaces costly handwork. Sweeps more than 38,000 sq. ft. on a single battery charge under normal operating conditions.

Sanitary. Reduces air-borne dust . . . gets dirt that pushbrooms miss. And there are no fumes, no odors, no noise . . . *when you sweep electrically!*

WRITE TODAY *for illustrated bulletin.* G. H. TENNANT Co., 771L N. Lilac Drive, Minneapolis 22, Minnesota.

OUTSTANDING FEATURES

- Sweeps a 34" path (max.) on the run. Propels itself at 1.9 mph
- Saves manhours. Sweeps up to 2000 sq. ft. in 5 minutes or less
- Rotary 17" side brush sweeps flush with wall; 26" main brush "floats" to follow floor contours
- High volume vacuum; sucks fine dust into 2200 sq. in. filter area
- Dual front-wheel drive; 1 hp motor; 2 cu. ft. removable dirt hopper
- Easy-to-use, finger-tip control. Stops when handle is released
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OUR 90th YEAR TENNANT

Industry's Most Widely Used **POWER SWEEPERS**

SPECIALIZED MAINTENANCE EQUIPMENT

For more facts circle 669 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 58)

Drill Press Mill Lowers Cost

STANDARD 17-in. Delta drill press mills the face of a two-inch hole in meter housings faster and at lower cost than a milling machine at Rockwell Manufacturing Company's Russellville, Ky., aluminum die casting foundry. It also permits use of a low cost machine instead of tying up an expensive milling machine and a skilled operator.

A piece of pipe has been fitted around the drill press spindle to guard the operator against flying chips. The guard is easily removed so that the tool may be used for conventional drilling when not needed for milling operations.

Standard drill press performs facing operation on meter housing, releasing expensive milling machine and skilled operator for more complex operations.

Air clamps, located on each side of the table, hold the work firmly during the milling operation. Clamps are applied and released by a conveniently located manual air valve.

Saves Time On Tool Crib Move

By KENNETH F. BIDDLE, Plant Engineer, Sundstrand Aviation, Rockford, Illinois

MOVING A TOOL CRIB or stockroom to another location can be an expensive, time consuming project. Bins are unloaded, moved to the new location and then loaded again. When we recently faced the prob-

"A major cost-reduction must come from costs other than direct labor and material costs! Management must pin-point actual materials handling costs"

You can best reduce manufacturing costs with...

R-W "TWIN-TRAK"
OVERHEAD AUTOMATIC DISPATCH SYSTEMS

An R-W "TWIN-TRAK" Overhead Automatic Dispatch System consists of one or more Power Tracks and as many Storage or Load Tracks as desired plus Switches, Carriers, Accessories and Power Equipment. "TWIN-TRAK" Systems are economical to install, operate and maintain . . . easily expanded, altered or relocated as necessary.

Industry's prime goal throughout the '60's will be to achieve substantial manufacturing cost-reductions. The handling of materials offers the greatest cost-cutting frontier and reduced costs will be accomplished only with a true "integrated" materials handling system . . . a system that co-ordinates all processing functions on a *door to door* or *plant wide basis.*

R-W "TWIN-TRAK" Systems offer this materials handling concept of tomorrow—*today*. For here is a completely automatic conveying system that not only moves products from one point to another, but automatically conveys parts and components to predetermined work stations throughout all production processes . . . parts and components that are automatically selected "from overhead" inventory banks and conveyed *where* they are needed—*when* they are needed. R-W "TWIN-TRAK" Systems not only improve materials handling but also permit the co-ordinated use of new production techniques and machinery to provide "machine muscle" for the raising, lowering, moving and transferring of parts and components to produce products faster and more economically. Now is the time to investigate the "cost-saving" potential offered by an R-W "TWIN-TRAK" Overhead Automatic Dispatch System.

If you are planning to modernize your present plant or build a new one, it will be to your advantage to let a qualified R-W Materials Handling Specialist survey your facilities or plans. At no obligation, he will gladly submit a plan to show you how to best solve your specific materials handling problem. Write for "TWIN-TRAK" Catalog.

R W

Richards-Wilcox

MANUFACTURING COMPANY
MATERIALS HANDLING DIVISION

460 W. THIRD ST., AURORA, ILL. Branches in all Principal Cities

For more facts circle 670 on Reply Card

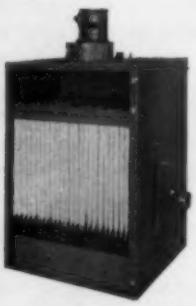
"THE GRIEVANCE COMMITTEE IS HERE ... ABOUT THAT DUST AGAIN!"

"This was the third time in a month that the grievance committee had complained about the dust in the shop. And this time they wanted to know what I intended to do about it.

"Frankly, I was on the spot. Oh, not that I blamed the workers. I knew the shop was dirty. How could it be anything else with grinding machines running 16 hours a day? And I was as unhappy about the situation as the employees were. Poor employee morale was serious enough—and absenteeism, machine wear, misalignment and down time caused by dust was costing plenty.

"Then I remembered a salesman with a dust collecting machine system had called on me a few months back. I dug his card out of the file and found he was from the Torit Company. I got him in pronto—and I bought one of his Model 90 Cabinet machines for less than $1,000. It services four surface grinders and it really performs. A month later I had Torit Dust Collectors installed for the rest of the machines.

"Torit Dust Collectors have practically eliminated the dust in our shop. And you can imagine the effect this has had on employee morale. People are happier and healthier. Absenteeism is no longer a problem and our production rate is higher than ever."



Cabinet Model 90

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 1831

For more facts circle 671 on Reply Card

OPERATION—PRODUCTION

(O and P begins on page 58)

Two sheets of plywood, angle irons and threaded rods are used to move bins.

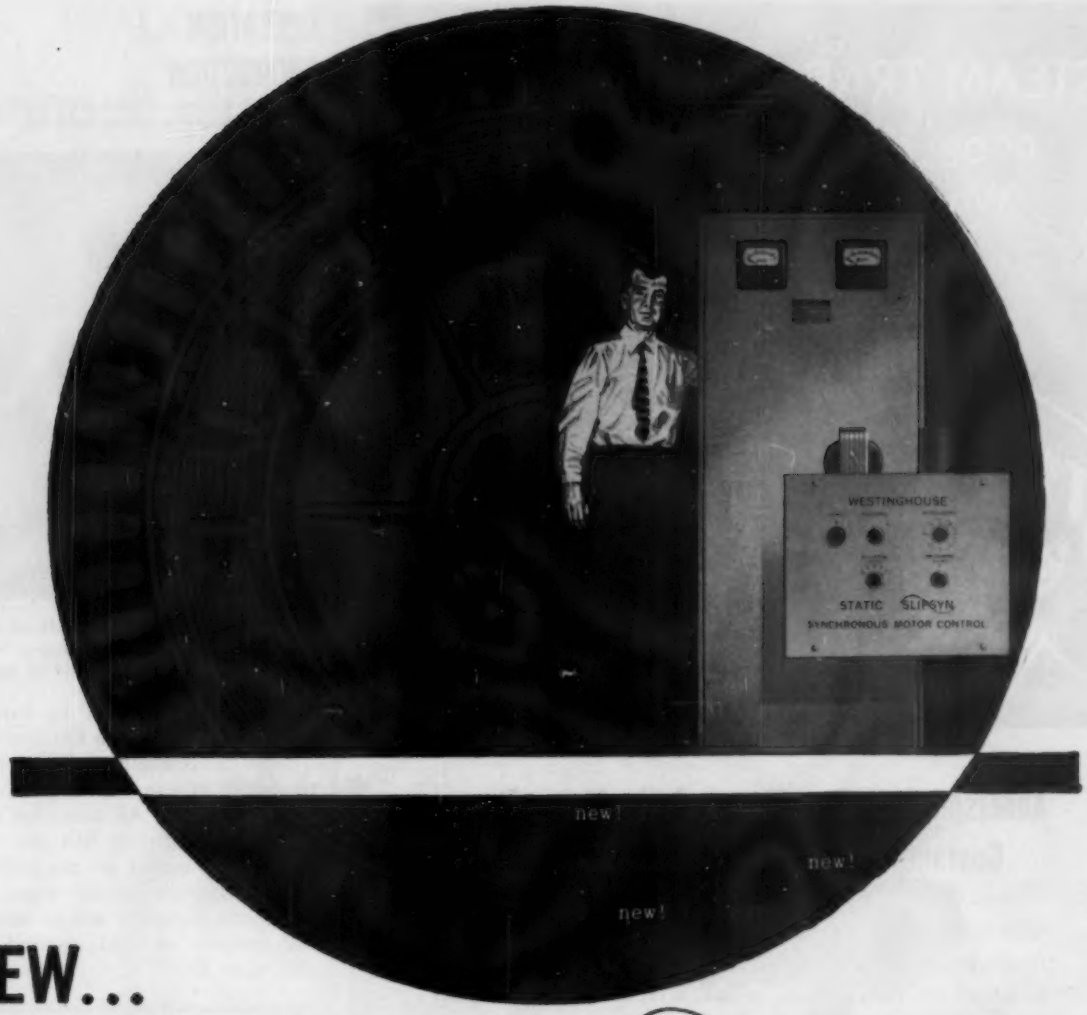
lem of relocating one of our stockrooms we tried out an idea that was designed to save the time and expense of unloading and reloading the bins.

Two sheets of ⅝-in. plywood were clamped to the faces of the bins with angle irons and threaded rods. The bottom angle iron has an additional flat welded to it providing needed area to support the bin when it is lifted with a fork truck.

In this way, the entire rack is transported to the new location without disturbing any of the parts in the bins. The plywood sheets, angle irons and threaded rod are removed and used to move the next bin. We feel the cost of the stockroom move was reduced by nearly one half by this method.

Water Treatment System Is Centrally-Located, Safer

SULPHURIC ACID used to control the acidity and alkalinity of water used in air conditioning systems is now handled by a safer method at the Timken Roller Bearing Company, Canton, Ohio. Formerly the six water treatment towers were serviced and tested individually by two men every 24 hours. It was a time-consuming operation and required maximum safety equipment for the employees since the acid



NEW... WESTINGHOUSE STATIC SLIPSYN CONTROL

UPS RELIABILITY, VIRTUALLY ELIMINATES MAINTENANCE

STOP PUZZLING over synchronous motor controls ... here's the advanced way to gain top performance. The all-new Westinghouse Static Slipsyn® control pays its own way by chopping motor control maintenance costs, practically eliminating down time and increasing reliability. Check these advantages:

WESTINGHOUSE STATIC SYNCHRONIZING CONTROL has no moving parts. It uses simple, reliable, transistorized networks instead of conventional relays ... no contacts, bearings and springs to corrode, wear and fail. Size and weight are greatly reduced—and Static Slipsyn control is immune to contaminated, dusty surroundings.

WESTINGHOUSE STATIC SYNCHRONIZING CONTROL precisely applies motor field excitation at proper speed and pole position up to and including 99% of synchronous speed. Pull-out protection is positive and adjustable to avoid false tripping.

FOR NEW AND OLD INSTALLATIONS. Your Westinghouse salesman will help you apply the completely packaged Static Slipsyn control to synchronous motor installations now being planned. And he can show you how static synchronizing control units can replace the conventional, mechanical relays in your present control enclosures. Either way, Westinghouse Static Slipsyn control saves big money through reduced maintenance, improved reliability, shorter down times.

Contact your local representative or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-25001

Westinghouse

For more facts circle 694 on Reply Card

Anderson Quik-Flex Thermostatic Steam Trap— Guaranteed Freeze-proof for Two Years!

Guaranteed when properly installed and operated, this freeze-proof Anderson Quik-Flex Thermostatic Steam Trap is ideal for tracer lines, meter boxes, drips and other outdoor steam processing equipment used in chemical, refinery, solvent and other industrial plants.

Correct installation requires free condensate drainage on the discharge side. A cooling leg of at least three feet is a necessity to cool condensate, since thermostatic traps operate on temperature differential. The strainer should be installed in a down position to avoid freezes which could break the strainer body.

A TRAP FOR EVERY PURPOSE

THE V. D. ANDERSON COMPANY
division of International Basic Economy Corporation
1939 West 96th Street · Cleveland 2, Ohio
Please send without obligation your Bulletin No. 257

Name_____ Title_____
Company_____
Address_____
City_____ Zone_____ State_____

ANDERSON QUIK-FLEX

For more facts circle 673 on Reply Card

OPERATION— PRODUCTION

(O and P begins on page 58)

Controller, top, measures pH of water and sets acid injectors, bottom, to deliver correct amount of acid to system.

jugs had to be carried by hand to each tower located on the roofs.

Now a centrally located water treatment system has been installed at ground level. All water for these towers is treated at this one location and pumped to the different towers through plastic pipes. An automatic metering device controls the amount of acid injected into the water.

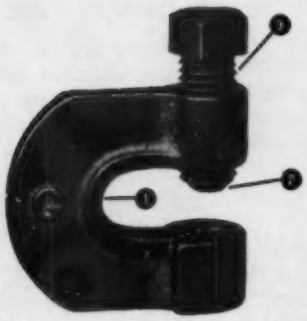
Fluid Power Maintenance

Various phases of fluid power maintenance are discussed in this 48-page reprint of a series of articles which have appeared in Plant Engineering.

The series covers all facets of fluid power maintenance from the installation of hydraulic systems to the maintenance of individual units in a system. Here is a brief listing of some of the 12 articles appearing in this reprint: How To Care for Hydraulic Pumps, How To Maintain Hydraulic Valves, Accumulators and Intensifiers, Maintaining Hydraulic Cylinders, Compressors, Filters and Lubricators, Air Control Valves and Spare Parts.

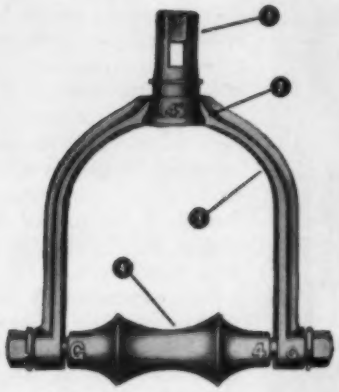
Price for this booklet is 75 cents. If you would like to have a copy of this series for your own file, send your request to the Editor, Plant Engineering, 308 E. James St., Barrington, Ill.

Look at all the extras you get in Grinnell Pipe Hangers . . . yet you pay no more!



GRINNELL C-CLAMP, FIG. 88 — 1 Ribbed, malleable iron casting, for extra strength **2** Hardened steel, cup-point set screw for good "grip" on beam **3** Full thread engagement – casting is drilled and tapped for rod and set screw

GRINNELL EXTENSION SPLIT RING, FIG. 138 — 1 Nipple engaging thick section of malleable iron gives rigidity for support from above, below or from wall **2** Tapped to take screw. No nut to lose **3** Special ring contour holds pipe or tubing firmly



GRINNELL ADJUSTABLE SWIVEL PIPE ROLL, FIG. 174 — 1 Swivel shank permits adjustment without elaborate support **2** Locking device prevents accidental adjustment change; no lock nut required **3** Ribbed design in malleable iron for better strength, lightness, appearance **4** Easy installation; maximum adjustment

GRINNELL CB CONCRETE INSERT, FIG. 282 — 1 One body size accommodates several sizes of rods **2** Slot takes reinforcing rods to assure maximum load rating **3** One-piece body prevents concrete seepage **4** Teeth on insert and nut hold rod firmly in place **5** Homogeneous composition of malleable iron throughout

You get *more* hanger for the money from Grinnell, because Grinnell's huge volume reduces production costs . . . lowers prices right into line with competitive hangers offering less.

Yet you get *so much more* . . . wider choice of types and sizes; better quality control; published ratings for *all* hangers; faster delivery from warehouses nationwide; and more responsible field service by trained Grinnell personnel . . . regardless of how far from the job site the sale was made! Grinnell Company, 277 West Exchange St., Providence 1, R. I. Branch Warehouses in Principal Cities.

Remember, The Best Costs No More — from America's #1 Supplier of Pipe Hangers and Supports

Call your local Grinnell Distributor for pipe hangers, cast and malleable iron fittings, malleable unions, steel nipples – all made by **GRINNELL**

For more facts circle 674 on Reply Card

FILLED TEFLON* BEARINGS

Chempro Filled-Teflon Bearings are tougher, harder, more wear-resistant and less subject to thermal expansion with the addition of specific filter compounds to virgin Teflon. Ideal for pumps, mixers, reactors and similar equipment where a chemically inert, non-corrosive, non-contaminating and non-adhering bearing material is a must.

Chemical & Power Products offers a complete Filled-Teflon Bearing service, including Chempro Finished Bearings either Pressed in Housings or without Housings, or Chempro Filled-Teflon Molded Tubes for machining bearings in your shop. Complete machining instructions furnished.

CHEMPRO FILLED TEFLON STYLES

FM-2	Glass-Filled Teflon
FM-3	Carbon-Filled Teflon
FM-4	Glass and Carbon-Filled Teflon
FM-8	Graphite- and Zircon-Filled Teflon
FM-9	Molybdenum Disulfide and Glass-Filled Teflon
FM-10	Mica- and Glass-Filled Teflon

Write for Bulletin CP-558.

*duPont trademark

CHEMICAL & POWER PRODUCTS, Inc.

7 Broadway, New York 4, N. Y.

For more facts circle 675 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

Quicker Thaw for Hopper Cars

THAWING FROZEN HOPPER cars at the Youngstown plant of U. S. Steel Corp., is now faster, simpler and less costly than the torching method formerly used. Now in use is gas-operated, infrared thawing equipment, including side panels, overhead heaters and undercar units which operate in concert.

The amount of heat supplied to different areas is tailored to the nature of the thawing problem in each area. Since hopper car pockets and slope sheets constitute the toughest thawing problem, the undercar, track-based units are designed to throw out approximately four million Btu per hour. Side

Thawing station for hopper cars has overhead, undercar units, side panels.

panels throw out some two million Btu per hour, while the overhead units, used to remove a top crust of frozen material, can do their job with only 300,000 Btu.

The units are already properly placed and need not be positioned each time they are used. One man can operate all the controls, which are located behind the equipment, with maximum safety from a protected position.

Under this system, cars do not remain in the thawing station long, and hence demurrage costs are lower. Damage to rolling stock during unloading is usually the responsibility of the company performing it. Infrared thawing, which does not damage the cars, has eliminated this problem. *From a release of Hauck Manufacturing Co., Brooklyn, N.Y.*

How To Prevent Cupping In Hardwood Floors

"CUPPING" in hardwood floors occurs when an unbalanced moisture content in the wood causes the underside of the flooring to absorb moisture at a faster rate than does the surface or face of the strip, according to a report issued by the Wood Flooring Institute of America.

A similar reaction often referred to as "cupping" takes place when the individual flooring strips absorb too much moisture from the surrounding atmosphere. This results in a dimensional change throughout the floor area. Since the finish flooring after installation is confined or restricted (by the adjacent pieces and the counter-active holding power of the nails) compression ridges form at the junction of the lateral edges of the individual strips. The extensive use of concrete on-grade floor slab construction has very substantially increased this problem, because of condensation which forms on the top of the concrete during the prolonged periods of high humidity.

Recommendations for eliminating the cupping problem include:

1. Design all on-grade concrete floor slabs 12 in. above the surrounding terrain for proper drainage of ground water.

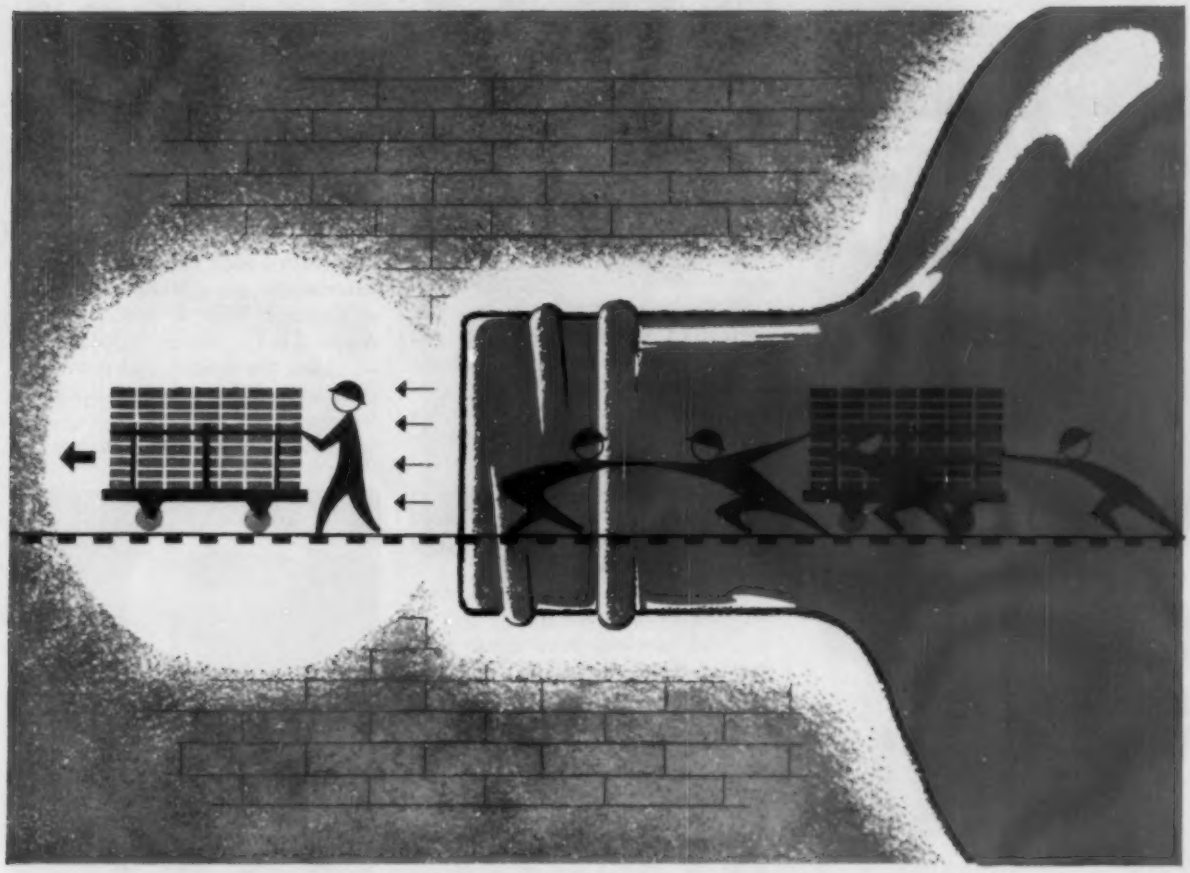
2. Waterproof all on-grade concrete floor slabs with pre-molded or multi-ply membranes or other accepted methods to prevent capillary or hydrostatic action.

3. When using a floor construction involving nailers or sleepers with air space between and underneath the finish flooring, design the slab with a built-in ventilating trench and exhaust fan attached.

4. Provide a minimum 1½ in. free expansion joint on all sides of any direct mastic laid wood flooring not of laminated construction.

5. Specify minimum 33/32 in. thickness preferably of edge grain with all steel-splined floor construction.

6. Use a minimum ½-in. corkboard underlayment for effective



New "hot" grease ends brick-oven bottlenecks

... and one man outperforms four!

Ceramic Combustion & Engineering Company, consultants for the Davidson Brick Co., Los Angeles, California, ran into production bottlenecks while using ordinary grease in dryer-car bearings. Oven temperatures (350° to 400° F.) cooked the grease solid . . . stalled the cars loaded with bricks in the dryer. Bearings seized so badly that four men were needed to move each carload.

Now—with Shell Darina Grease 2 as the lubricant, Davidson reports: "Bearings roll free, even at 400° F., one man, instead of the four previously required, can *easily* roll a carload of bricks . . . no more bottlenecks caused by frozen bearings."

Darina® Grease 2 is an economical, multi-purpose grease with exceptional stability in high-temperature applications. It offers these outstanding qualities:

HIGH-TEMPERATURE PERFORMANCE. *100° F. better* than conventional multi-purpose greases.

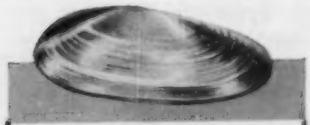
EFFICIENT SEALING. Contains no soap —nothing to melt and run out.

HIGH RESISTANCE TO WATER WASH-OUT. Doesn't dissolve or separate when mixed with water . . . lubricates efficiently under wet conditions.

POSITIVE RUST PROTECTION. Protects bearings even under severe moisture conditions.

ECONOMICAL. Savings up to 35% in grease and labor costs alone are possible because of Darina's superior performance over a wide range of plant operating conditions.

For more information on Darina Grease, write: Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California. In Canada: Shell Oil Company of Canada, Limited, 505 University Avenue, Toronto 2, Ontario.



An Interesting Fact! Every Shell Branded Industrial Lubricant is named for a sea shell. Shown here: Darina solenoides.

SHELL DARINA GREASE

the multi-purpose, high-temperature grease

For more facts circle 676 on Reply Card

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DEPENDABLE
VALVES for TIGHT SEALING
in those
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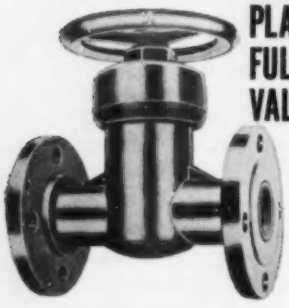
PENTON COATED DIAPHRAGM VALVE

This valve uses a rubber diaphragm to seal the fluid in valve body and a rubber covered disc to close the valve tight. Penton coating of body provides protection against corrosive action. Valve has high capacity—low pressure drop. Available in ½" to 6" sizes; manual or mechanical operators. Air diaphragm operated unit shown here. Write for Bulletin 800C.

ALL PLASTIC FULL FLOW VALVE



Valve with body in wide choice of plastics. Soft rubber or elastomer plunger seals off fluid flow. Full straight-thru design, with no obstructions or reduction in cross section area when full open, minimizes pressure loss. Sizes 1" to 2". Write for Bulletin 802D

W. S. ROCKWELL CO.

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For more facts circle 677 on Reply Card

PLANT ENGINEERS' DIGEST

(Digest begins on page 40)

thermal insulation as well as resilience under all steel-splined floor construction laid over on-grade slabs (except where such floors are to be subjected to very heavy loading).

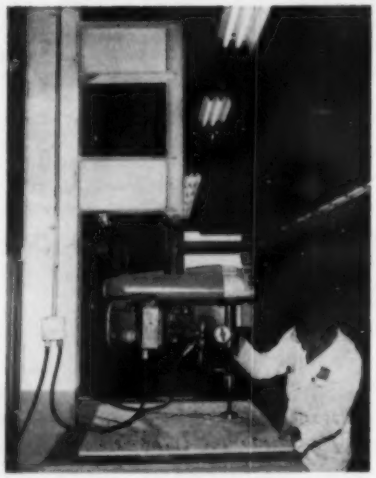
7. Depending upon the moisture content of the finish flooring and the conditions within the building at the time of installation, permit the flooring contractor to use his discretion as to spacing of the newly laid flooring.

8. Provide adequate fan capacity for forced air ventilation year round in the area where wood flooring is to be installed.

9. Whenever practical, provide humidity control within this area by mechanical equipment either as a part of the heating and ventilating system or in the form of independent units. *From a release of Maple Flooring Manufacturers Association, Chicago, Ill.*

Drilling Large Panels

HANGING A STANDARD 17-in. drill press from a building column makes it possible to drill holes at any point



Drill press hung from column, reaches any part of 4-ft by 8-ft plywood panels.

on 4-ft by 8-ft panels at United Air Lines' Engineering and Maintenance Base, San Francisco.

The bracket holding the drill head consist of 3½-in. pipe—the diameter of the drill press column—and short lengths of I-beam. The drill press will rotate through 300 deg. An air jet is used to clean sawdust from the cutting tool. *From a release of Rockwell Manufacturing Co., Pittsburgh, Pa.*

Clean Air Reduces Motor Maintenance

MAINTENANCE costs on a 500-hp mixer motor and a 50-hp mill motor at General Tire & Rubber Co., Waco, Tex., were reduced by shrouding the motors and providing a closed cycle of super cleaned cooling air.

Air that enters the motors is

Filtered, clean air is supplied to shrouded mill motor, reducing maintenance.

filtered through a standard cloth tube-type dust collector and a special filter aid that remove all atmospheric dust.

The clean air is ducted to the motors under slight pressure, thus preventing dust from entering the air stream, even if a small leak should develop. Since this is the only source of ventilation, a pressure switch is inserted in the duct so that the contacts are closed when the filtration unit blower is functioning properly and the discharge duct and motor are under pressure.

The pressure switch is connected in series with the control circuit of the motor controller. Therefore, the motor cannot be started until the proper ventilation is supplied. Failure of the ventilation system to supply a sufficient amount of air will stop the motor. *From a release of Wheelabrator Corporation, Mishawaka, Indiana.*

New Plant Construction

(Continued from page 204)

$3-million plant at Union Boulevard and Riverview Drive, this city, to house finishing and distribution facilities for products sold in the United States. The 236,000-sq ft structure will be of masonry on steel frame and will be faced with white brick. Work on the structure will get under way at once and will be completed in the summer of 1961.

Toledo, O.—Sun Oil Co., Walnut and Sixteenth Streets, Philadelphia, Pa., has awarded a contract to the M. W. Kellogg Co., 711 Third Ave., New York, N. Y., for the engineering and construction of an $8-million naphthalene plant to be built at company's Toledo refinery.

Duquesne, Pa.—U.S. Steel Corp., 525 William Penn Place, Pittsburgh, Pa., plans to construct an ultra modern blast furnace at its steel works, located here. New furnace will have advanced design features which will permit it to be used for research studies as well as commercial iron production. New unit is expected to produce about 850,000 tons of molten iron annually. Site preparation and preliminary work is already under way and the new unit is scheduled for completion by January 1963. Total cost is expected to be between $15 and $20 million.

Eddystone, Pa.—Scott Paper Co., Market at Marcus Streets, Chester, Pa., plans to construct a plant for the manufacture of plastic drinking cups for hot beverages, and Scottfoam, a synthetic material used primarily as a laminate on fabrics and as an air filter. Construction of the plant will get under way immediately for completion in the second quarter of 1961. Plant when completed will represent an investment in excess of $3 million.

Hampton, S. C.—Westinghouse Electric Corp., Pittsburgh, Pa., plans major expansion of facilities at plant here for the manufacture of high pressure decorative plastic laminate. Production will be increased by about 75 per cent and the expansion program will include new equipment, a laminating press, and 40,000 sq ft of new manufacturing space to the existing plant. Work will get under way at once for completion in late 1961.

Falls City, Texas—Susquehanna Corporation has announced completion of contract negotiations with the Atomic Energy Commission, Washington, D C., for the construction of a uranium ore processing plant, near here. Plant to be built by a company subsidiary, Susquehanna-Western, Inc., is expected to cost in excess of $2 million and will have a rated capacity of approximately 200 tons of ore per day. Work on the new plant is already under way and completion is slated for early 1961.

Green River, Wyo.—Stauffer Chemical Co., 382 Madison Ave., New York, N. Y., plans to construct a soda ash plant near here. Plant will have a capacity of from 150,000 to 200,000 tons of soda ash a year.

Free 11" x 17", 4-color Wall Chart, suitable for hanging.

In seconds, you can find every known wiring device configuration on this color-coded, 11" x 17" wall chart . . . and it's yours absolutely free if you mail the coupon below.

Alongside each female configuration is listed (1) its rating, (2) the catalog numbers of matching caps, receptacles, and connectors, (3) its page number in the Hubbell catalog.

Color blocks tell you quickly whether the configuration belongs to Grounding, Straight Blade, "Twist-Lock", or "Hubbellock" devices. You'll wonder how you ever got along without it!

This same 4-color chart information is also available in catalog page size (8½" x 11", 3-hole punched). Either the big wall chart or the 2-sided catalog page is absolutely free. Act now while the supply lasts.

ANOTHER TIME-SAVER!

18-Page Wiring Device Selector Guide . . . Only 50¢

In this handy, desk-sized selector guide, you can locate the catalog number of any Hubbell connecting device in a matter of seconds. Here's how it works:

1. Four index tabs—color-coded to match your wall chart—quickly guide you to pages listing Grounding, Straight Blade, "Hubbellock", and "Twist-Lock" configurations.
2. Configuration diagrams and ratings at the top of each page guide you to the column you want.
3. In this column you find catalog numbers and brief descriptions of all receptacles, caps, bases, and connectors made in this configuration, and their page numbers in the Hubbell catalog.

At only 50 cents a copy, this guide will more than pay for itself in time saved and errors prevented. Our supply is limited. So tape two quarters or five dimes to the coupon below, enclose in envelope, and get your copy by return mail. (Please print clearly.)

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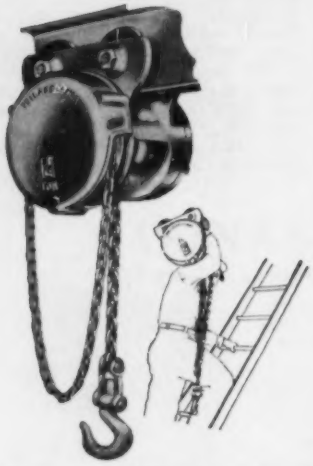

Model "R". Originally developed for Government services to meet following requirements: Heavy duty yet light in weight; fully adjustable to wide range of I-beams and patent track monorail systems; less headroom than standard Army Type Hoists. Made of aluminum but available in spark-resistant metals. Readily convertible from push type to geared. All bearings have sealed-in, lifetime lubrication. Capacities: ½ to 10 tons.

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NEW BOOKS

for the plant engineer

Engineering Economics

ENGINEERING ECONOMY by William T. Morris. Size 9¼ by 6¼ in.; 506 pp including index; cloth bound. Published by Richard D. Irwin, Inc., Homewood, Ill. Price $10.50.

THE AUTHOR of this book is an associate professor of Industrial Engineering at the Ohio State University. Basically, this book is a textbook for the education of students at the university level. It can, however, be of value to plant engineers who feel a need for knowledge on engineering economics.

Mathematical formulas appearing in the book include the use of Calculus and knowledge of mathematics through this branch is recommended for better appreciation of the contents. In his preface comments the author also presumes acquaintance of the student with accounting, probability theory and economics.

Among the 26 chapter topics treated in the book are the following: the fundamentals of engineering decisions; prediction and judgment; taxes; replacement policy; inventory policy; game theory; statistical decisions; the economics of automation; simulated decision making; and how decisions are made.

Problems are presented at the end of chapters. There are four appendixes in the book; interest calculations and interest tables appear separately in two of these. An extensive listing of selected references is also contained in the book.

On Plant Engineering

TECHNIQUES OF PLANT MAINTENANCE AND ENGINEERING. Size approx 11¼ by 8½ in.; 341 pp; cloth bound. Published by Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N.Y. Price $10.00

PAPERS and proceedings of the 1960 Plant Maintenance and Engineering Conference held in Philadelphia appear in the latest addition to the series reporting on the conferences over the years; it is volume No. 11.

Discussions involving speakers and conferees follow the presentations of various talks that were given. Among the papers published in this book are the following: How we control maintenance; research and development techniques in maintenance; getting at true maintenance costs for purposes of comparison; data processing equip-

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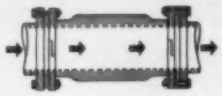
- Cannot leak or stick.
- No working parts in contact with pulp or liquid; no packing glands.



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★ 9-in-10 washers are fastened with TOO LONG or SHORT SCREWS thus loosen and destroy themselves. Leaks quickly follow!

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★ New, patented 'Sexauer' SELF-LOCK screws have imbedded expanding NYLON PLUG. They lock at required depth AUTOMATICALLY, hold washers firmly! Made of MONEL, they are rustproof, non-corroding. Heads can't twist off. Screw slots can't distort.

★ NEW, improved 'Sexauer' EASY-TITE faucet washers are made of super-tough, pliable du Pont compound (not rubber or fibre). Reinforced, like a tire, with a vulcanized layer of Fiberglas, they resist distortion and splitting from shut-off grind and squeeze.

★ Faucet leaks repaired with 'Sexauer' EASY-TITE washers and SELF-LOCK screws outlast ordinary repairs "6-to-1"!

HIDDEN COSTS OF FAUCET LEAKS!

Hackensack, N.J. Water Co. and American Gas Association figures prove stopping just ONE PIN-HOLE SIZE (1/32") LEAK saves you 8,000 gal. water quarterly. A HOT WATER FAUCET LEAK repair saves you over $7.58 QUARTERLY in fuel and water bills. Fewer leaks also produce important savings on MATERIALS, LABOR and COSTLY FIXTURE REPLACEMENTS!

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NEW BOOKS

ment in maintenance work; and what the plant engineer should know about building and evaluating maintenance performance.

The round table sessions which are covered in this publication pertain to such areas of interest as metalworking and metal fabricating plants; research, development and pilot plants; steel and textile mills; and others. Some of the subjects discussed in the round table meetings are: scheduling; maintenance organization; industrial waste; lubrication; contractors; maintenance training; and maintenance responsibilities.

Automatic Equipment

AUTOMATING THE MANUFACTURING PROCESS by George F. Hawley. Size 9¼ by 6⅛ in. approx.; illustrated; cloth bound. Published by Reinhold Publishing Corp.; 430 Park Ave., New York 22, N. Y. Price $4.95.

THIS BOOK presents a practical approach to problems dealing with phases of action that enter into the creation of automatic equipment. It alerts management and other personnel to the risks involved in venturing into new machine projects.

In the first chapter the author briefly discusses the subject of automation; a chapter on economic feasibility follows. The book goes on with matter pertaining to contracting work with an outside firm.

Topics of some of the remaining eleven chapters are: invention; building a model; engineering; the design phase of a specific project; building the automatic machine; debugging; and the run-in period.

Piping, Pressure Vessel Design

PRESSURE VESSEL AND PIPING DESIGN. Size 11¼ by 9 in.; 710 pp; illustrated; cloth bound. Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N.Y. Price $10.00.

REPRINTS of technical material dating from 1927 to 1959 appear in this imposing tome. This information should not be considered as additional requirement to codes published by the ASME.

There are ten sections in this book dealing with numerous topics. Among the latter are the following: reinforcement of openings in pressure vessels; formulas for stresses in bolted flanged connections; gaskets for high pressure vessels; report on the design of pressure vessel heads; method of supporting spheres for the storage of liquids;

NEW!

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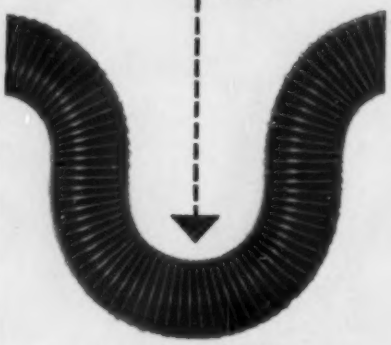

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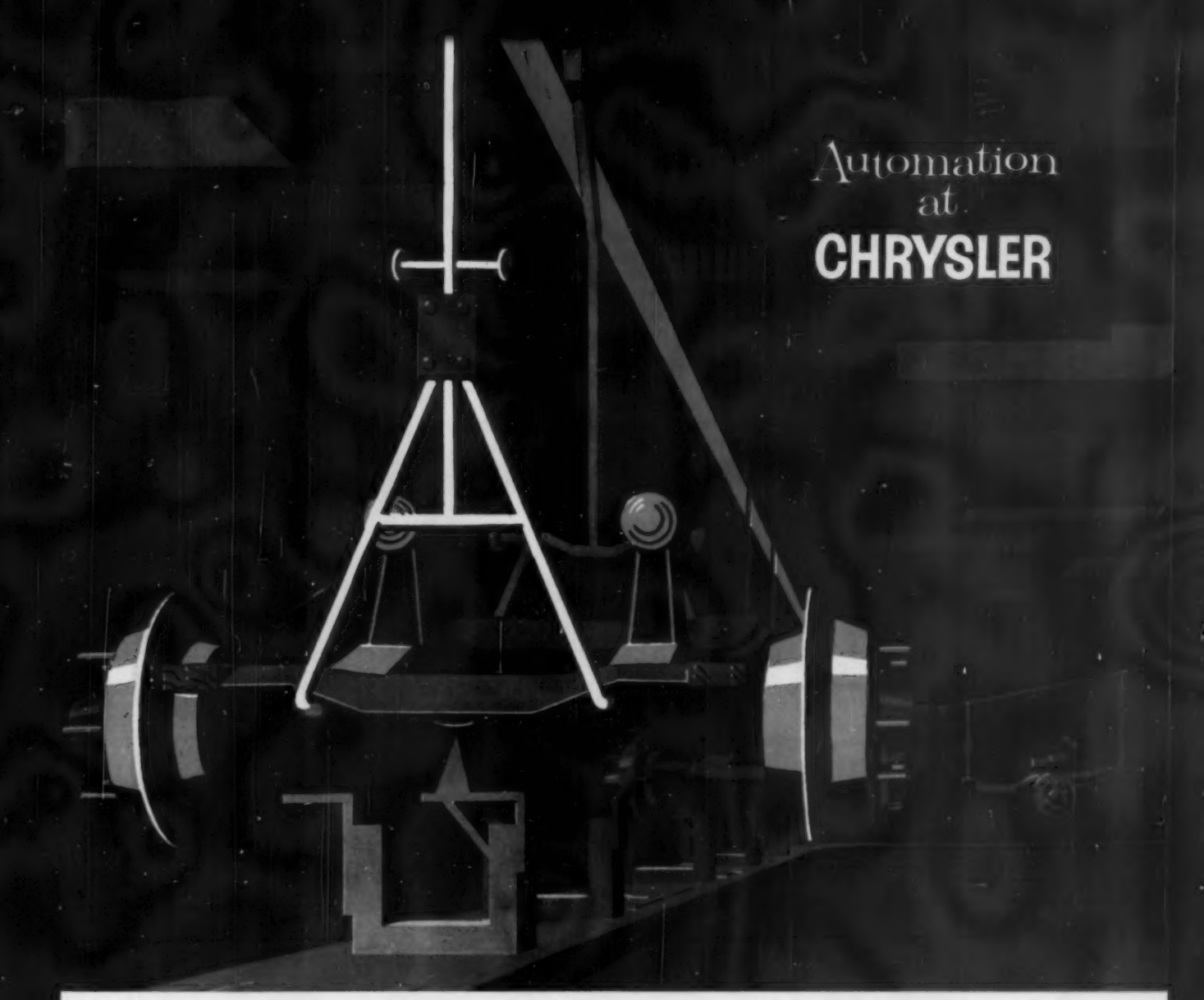

VARIDYNE a/c drive system synchronizes assembly conveyors

Problem: Chrysler Corp., Dodge Division, new unitized body assembly lines required linkage of three *variable-speed, continuous motion* conveyors—stub frame overhead, main assembly pedestal and final assembly flattop. At transfer point, shown above, pin in conveyor must match hole in frame with no cumulative error.

Solution: U. S. VARIDYNE a/c Drive System with *LinkSync* control. Chrysler engineers working with U. S. Motors field engineers chose VARIDYNE over a d.c. system because: initial start-up is simplified; instantly synchronous without warm-up; needs no synchronizing readjustments; there is no cumulative error; and maximum reliability is assured by use of *standard a.c. motors*. VARIDYNE varies the frequency of a.c. current to these motors, converting them to adjustable speeds. *Write today for* VARIDYNE *Brochure F-1963.*

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One man with a Roura Hopper can do the work of two and do it in half the time. Loaded Hopper is picked up by the truck operator in a matter of seconds. Platform or forks slip into underframe and it can't slip off.

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Thousands of Roura Hoppers are now in use handling scrap metal, hot forgings and castings, cinders and aggregate, pickles—and dozens of other items.

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They're made in eight sizes, ⅓ to 4 yards capacity. Built of 3/16" steel plate with continuous arc-welded seams. Heavier plate if desired, also stainless steel or galvanized. Mounted on live skids or with a choice of wheels. Can ship standard models immediately.

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NEW BOOKS

stresses and reactions in expansion pipe bends; elements of joint design for welding; stresses from radial loads in cylindrical pressure vessels; and design assumptions, stress evaluation, and design limits.

Engineer's Pocket Aid

THE ENGINEER'S VEST POCKET BOOK. Size 5¾ by 2⅞ in. approx; 192 pp including index. Published by Ottenheimer Publishers, Inc., 4805 Nelson Ave., Baltimore 15, Maryland. Price 90 cents.

IN THIS POCKET size reference there is an assortment of information for engineers. The total number of charts and tables included are 47.

Sections of the book are edge marked for ease of reference. These deal with: mathematics, mechanical items, structural details, heat, hydraulics, piping, electricity, surveying, costing, mining, chemistry, etc.

Plastics Application Series

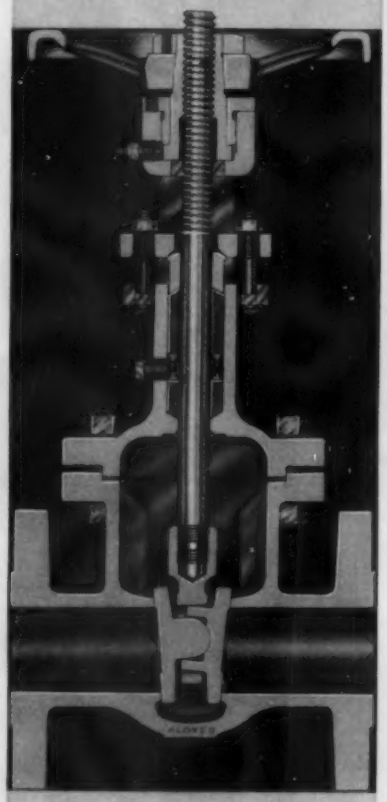
The three books mentioned in the following passages are part of the series published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. They are cloth bound and each measures 7⅝ by 5¼ in.

Polyester Resins by John R. Lawrence. 251 pp including index; illustrated; price $5.75. Discussion in this book takes in the historic background, chemistry, curing mechanisms, manufacturing, and the processing of resins for applications. The book includes an extensive tabulation of standard resins grouped according to manufacturers.

Metallizing of Plastics by Harold Narcus. 208 pp including index; illustrated; price $5.50. This metallizing manual contains details on commercial metallizing processes for plastics or other nonconductors. It deals with actual production procedures, formulations and techniques for metallizing.

Runnerless Molding by Ernest P. Moslo. 162 pp including index; price $4.95. The book presents different techniques of injection molding. It brings out ways in which runnerless molding may be used to effect certain advantages along with the increase of production speed. Among the topics treated in this publication are the following: multiple-cavity runnerless molds; large section runnerless molding; sequential impact molding; and thin-wall container molding.

FOR HIGH-PRESSURE CORROSIVE SERVICE:



300 lb. Aloyco Stainless Steel Gate Valves

Figure 2117 double disc. (above) Available in sizes ½" to 8".
Figure 2217 for solid wedge.
Sizes ½" to 12".
In addition—screwed, and socket weld ends.
Sizes ½" to 2".
Other 300 lb. designs including globes, swing and lift checks; jacketed and tank valves.
600 lb. designs also available.

Materials
Types 304 and 304L
Types 316 and 316L
Aloyco 20
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For more information on Aloyco valves for your specific corrosive service, write for Bulletin #7 to Alloy Steel Products Company, 1301 West Elizabeth Ave., Linden, New Jersey...the one manufacturer specializing in Stainless Steel Valves exclusively. 9.3

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JOHNSON V-530 PRECISION PILOT POSITIONER

FOR RUBBER DIAPHRAGM OPERATED VALVES

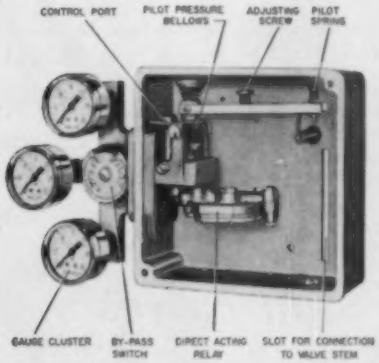
V-530 PRECISION PILOT POSITIONER

PILOT POSITIONER APPLIED TO VALVE

The Johnson V-530 Pilot Positioner is designed for application to the larger size valves for precise repositioning even for very small changes of air pressure from the controlling instrument.

- *Powerful* — repositions with maximum power at all times. Utilizes supply air at 15-20 psi; does not operate from control air from controlling instrument.
- *Fast* — proportional action, direct acting pneumatic relay repositions valves approximately six times faster than ordinary pilot positioners.
- *Accurate* — adequate air handling capacity for the larger valve tops. Positioner completely eliminates influence of stuffing box friction or of fluctuation of steam or liquid pressures.
- *Low Air Consumption* — uses no more air than an ordinary room thermostat. Minimizes compressed air requirements.
- *Easily Adjustable* — a single screw beneath the cover adjusts operating range between 3-16 psi and starting point between 0-20 psi.
- *Options* — available with by-pass switch for uninterrupted operation during servicing. May be equipped with gauge cluster to show supply pressure, pilot pressure, and output pressure to the valve top.

For complete details, write for Bulletin V-530. Johnson Service Company, Milwaukee 1, Wis.



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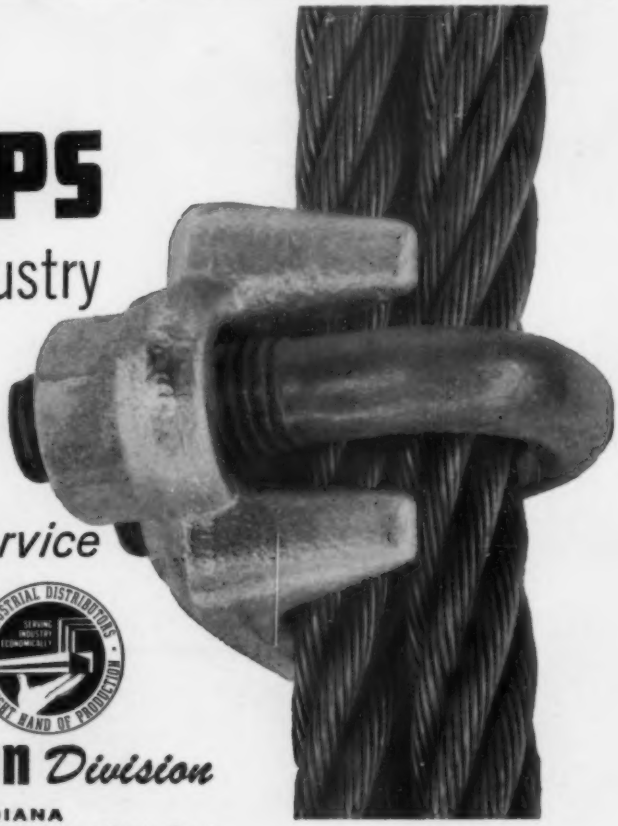

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BULLETINS

(Begins on page 21)

Stored Energy Switchgear—Features and advantages of I-T-E Circuit Breaker Co. stored energy metal-clad switchgear are detailed in 20-pp Bulletin 2801-2A. Panel layout and dimensions are illustrated and ratings tabulated. I-T-E Circuit Breaker Co.

▲ For a copy, circle 142 on Post Card

Electrical Operators—Booklet B-7534 tells how to apply electrical operators for the remote control of circuit breakers. Electrical operator dimensions are given and applications shown. Westinghouse Electric Corp.

▲ For a copy, circle 143 on Post Card

Switch, Fuse Equipment—Eight-pp Bulletin GEA-6623B describes redesigned switch and fuse equipment that incorporates rollout feature for easy maintenance. Illustrated with photos, cutaways, diagrams and tables, bulletin gives maintenance and installation information. General Electric Co.

▲ For a copy, circle 144 on Post Card

Electric Motor Controls—Pocket Catalog 60, 56-pp, gives descriptions, ratings, prices for manual and magnetic starters, drum controller, pressure, foot and limit switches. Included are push buttons, related pilot devices, motor rating, heater coil data, and tables for control selection. Furnas Electric Co.

▲ For a copy, circle 145 on Post Card

Electrical Connectors—Twelve-pp Bulletin PR-259-1, describes single-conductor plugs and receptables for line-to-load plug-in connections in distribution and power supply panels, production equipment and other applications. Includes ratings and outline dimensions. The Superior Electric Co.

▲ For a copy, circle 146 on Post Card

Miniature Oil-Tight Pushbuttons—Bulletin GEA-7127, 10-pp, illustrated in color, features industrial miniature oil-tight pushbuttons. Illustrations show flexibility and advantages of the line and how it can reduce panel space requirements 40 per cent. Dimensions, ratings are provided. General Electric Co.

▲ For a copy, circle 147 on Post Card

TOOLS, WELDING AND MACHINE SHOP EQUIPMENT

Welding Data—This 148-pp pocket-size maintenance welding data book provides a guide, indexed by application, to nearly 200 Eutectic welding rods, electrodes, and chemical aids. It illustrates and explains general welding techniques and joint design hints, and covers such topics as elimination of warping, distortion, embrittlement and other base metal damage; wear, impact and corrosion resistance, color match, machinability. Eutectic Welding Alloys Corp.

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For Screwdriving, Nutsetting—Catalog N.S. 60, on power portable air tools for screwdriving and nutsetting, is a 28-pp tool selection manual concentrating on torque ranges from 2 to 160 in.-lb. Determining factors for selecting proper tool, as outlined in catalog, are: motor size and speed, clutch, and handle style. When added to manufacturer's basic knowledge of thread size, torque requirements and assembly conditions, proper selection is simple. Master Power Corp.

▲ For a copy, circle 151 on Post Card

Throwaway Insert Milling—Illustrated and described in 24-pp Catalog V. M. U. 60-A are throwaway insert milling cutters. Provides data on cutter bodies, cartridges, inserts and accessories for milling cast iron, steel, aluminum and non-ferrous metals. Cutter body and cartridge details, insert shapes, lead angles and rakes, standard drive dimensions and accessory details are illustrated. Valenite Metal, Div., Valeran Corp.

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HEATING, VENTILATING AND AIR CONDITIONING

Supplies and Equipment—Air conditioning, ventilation, refrigeration and heating supplies and equipment are listed in this 40-pp 1960 Estimating Guide supplied by Blazer Corp. Quick selection of blower units, fans, coils, cooling towers, evaporative condensers, valves, fittings, etc. is made possible by graphic illustrations and quick selection tables, accompanied by pricing tables. Blazer Corp.

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Gas-Fired Heaters—Features and advantages of company's gas-fired industrial type vertical delivery unit heaters are detailed in Bulletin IGV-660. Cutaway view showing component details, dimensional diagrams, performance data and specifications included. Modine Mfg. Co.

▲ For a copy, circle 154 on Post Card

Acoustical Control Units—Detailed description of acoustic terminal control units for all-air high-velocity systems is contained in 36-pp Catalog 1060. It provides information and specifications on three ceiling models and two window/perimeter models, engineering data on system noise and tables of static-pressure losses and regains. Carnes Corp.

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Light, Air Diffusers—Detailed information on combination light and air diffusers is contained in 24-pp Catalog F 9768. Data for selecting and predicting performance, and drawings illustrating how the light and air diffusers are installed and balanced included. Barber-Colman Co.

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Industrial Ventilators—Bulletin G-101 describes and illustrates eight types of ventilating units, including continuous types, round gravity and round power ventilators, automatic power ventilators, axial flow duct fans, louvers and lovered ventilators. Includes application suggestions, sizes and capacities. Bowman Steel Corp.

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Postage-free Reader Service Cards make it easy to order bulletins. Cards are provided on the facing page.

Packaged Air Conditioners—Performance characteristics and engineering features of packaged air conditioners are detailed in color illustrated Bulletin 8825, 12-pp. Typical installation photos showing units with and without discharge plenum are included. A ready-reference table is provided to give physical data and capacities. Industrial Div., American-Standard.

▲ For a copy, circle 158 on Post Card

Central Air Conditioning—Illustrated and described in 14-pp Bulletin 404 is a line of air conditioning, heating and ventilating central station units from 400 to 30,000 cfm. Includes sizing data graphs and complete specifications. Airtherm Mfg. Co.

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Be Your Own Weatherman—This 16-pp booklet gives interesting tips on weather forecasting to help you be your own weatherman. Also describes some simple do-it-yourself tests to make to assure safe and satisfactory plant ventilation. Ilg Electric Ventilating Co.

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PROCESSING EQUIPMENT

For Process Industries—Twelve-pp Bulletin G-3D describes equipment for process industries. Discusses applications and performance characteristics of pumps, pneumatic conveyors, fluidizing conveyors, rotary compressors and vacuum pumps, horizontal-grate coolers, suspension-type preheaters, positive displacement blowers and gas pumps, and induced draft fans. Fuller Co.

▲ For a copy, circle 161 on Post Card

For Processing, Heat Transfer—Description and specifications on laboratory and production blenders, vacuum tumble dryers, packaged pilot plants, process heat exchangers, a solids-processor, and general-purpose solids-flo valve are presented in 20-pp Bulletin 16-P. Using tables and diagrams, bulletin lists standard dimensions. The Patterson-Kelley Co., Inc.

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Propeller Type Mixers—Portable and fixed mounting propeller type mixers are illustrated and described in Bulletins B-520 and B-521. Dimensional data and diagrams are included. Mixing Equipment Co., Inc.

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Crushing Handbook—This 40-pp Handbook of Crushing covers subject of mechanical size reduction, describing various reduction methods—impact, attrition, shear and pressure—and many kinds of crushing equipment. Illustrated with diagrams and charts, it contains data on closed circuit crushing systems, factors in selecting methods. Pennsylvania Crusher Div., Bath Iron Works Corp.

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BULLETINS

(Begins on page 21)

Suggestion for Coping With Corrosion Problems

Corrosion Problem Solutions—Polyvinyl chloride, polyethylene and polypropylene exhaust systems are detailed in bulletin from design to completion. Systems provide corrosion resistance for all fume handling problems. Installation data sheets supplied. Plastic Industrial Fabricators, Inc.

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Penton's Corrosion Resistance—This 6-pp folder, a revised edition of the "ABC's of Penton" covers resistance of this versatile plastic to nearly 400 chemical reagents, including about 80 not previously listed. Tabulated data enables evaluating behavior of Penton in a variety of corrosive environments. Included with this folder is another covering solid and lined Penton pipe and fittings. Hercules Powder Co.

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Corrosion Control—Methods used in steam-condensate systems for control of corrosion are described in Process Bulletin B-6. Covers use of filming corrosion inhibitors and neutralizing amines for low, medium and high makeup systems. Illustrations show how inhibitors form a protective film and the amines neutralize carbon dioxide. Nalco Chemical Co.

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For Corrosive Locations—Twenty-pp Bulletin 2699 describes Condulets for corrosive locations. Corrosive substances are listed in tabular form with appropriate corrosion-resistant metals and finishes used. Crouse-Hinds Co.

▲ For a copy, circle 169 on Post Card

INSTRUMENTS, CONTROLS

Supervisory Equipment—Eight-pp Bulletin GEA-7043 describes features, dimensions and operating characteristics of company's solid-state supervisory control equipment. Contains photos, drawings and diagrams of the equipment which uses solid-state components to provide low-cost centralized operation, indication and telemetering of remote apparatus. General Electric Co.

▲ For a copy, circle 171 on Post Card

Magnetic Pickups—To assist potential users of these self-generating input devices in selecting pickup best suited for an application, Bulletin CMP-50 explains how these transducers can be used for accurate mechanical-electrical conversion. A chart simplifies pickup selection. Electro Products Laboratories, Inc.

▲ For a copy, circle 172 on Post Card

Weather Sensitive Controls—Automatic controls that govern inside comfort by outdoor temperatures are described in Bulletin G-0260. Covers Weather-Man units which measure the weather, reset heating rate and hours proportionately; and Weather-Flo regulators to effect continuous circulation of water or air at right temperature. Automatic Devices, Div., American Machine and Metals, Inc.

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Manifolds, Regulators—Oxweld industrial gas regulators and portable manifolds are described and illustrated in 16-pp Form 55-085. Catalog includes specifications and ordering information for regulators available for all industrial gases and portable manifolds for use with oxygen and acetylene. Recommended uses and installations are included. Linde Co., Div., Union Carbide Corp.

▲ For a copy, circle 176 on Post Card

Water Treating Instrumentation—Discussed in 28-pp Bulletin B96-2 is instrumentation for treatment of industrial water. Describes typical water treating systems used in processing industries. Minneapolis-Honeywell Regulator Co.

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OTHER EQUIPMENT

Steel Lockers—Illustrated and described in 24-pp Catalog 6000 are nine locker styles for industrial and other applications. Design and construction features are detailed, and dimensional data included. Penco Div., Alan Wood Steel Co.

▲ For a copy, circle 178 on Post Card

Back-Up Rings—Catalog 5482, 8-pp, shows how to increase O-ring life—seal higher pressures, reduce costs—with use of the contoured and continuous back-up ring, Parbak. It includes sizes. Parker Seal Co.

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Maintenance Coatings—Bulletin P-57 describes company's MIM (minimum-interruption maintenance) coatings for food, chemical and paper industries and other applications. Those covered include epoxy coatings, synthetic rubber Hypalon coatings, liquid zinc coatings for galvanizing, rust-inhibitive coatings, chemical resistant floor coatings, damp surface coatings, types for subfreezing maintenance painting. Wilbur & Williams Co.

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Safety Enclosures—Section 2C, 1961 edition is a 32-pp catalog illustrating glove, vacuum and dry boxes, as well as controlled atmosphere systems for research and production purposes. Also described and pictured are special enclosures and equipment made to individual plant requirements. Kewaunee Scientific Equipment Div., Kewaunee Mfg. Co.

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94 Chemicals Reviewed—Organic and inorganic chemicals—94 in all—produced by this company are reviewed in this 16-pp Bulletin 100-D. Gives factual information on 88 commercially produced products, six development ones, including 20 recently developed chemicals. Covers acids, alkalies, the elements chlorine and phosphorous, metallic salts, phosphorous and sulfur compounds, chlorides, chlorobenzenes, others. Hooker Chemical Corp.

▲ For a copy, circle 182 on Post Card

Refrigerated Storage—Eight-pp Bulletin G-48 describes design and function of facilities for storing liquefied gases between +32 F and —50 F. Advantages discussed include: economy, safety, consistency, accessibility, accurate gaging, expansion simplicity and volume. Illustrations include vessels now in service and cutaway drawings of vessel types with descriptions of refrigerating systems. Chicago Bridge & Iron Co.

▲ For a copy, circle 184 on Post Card

DATA FILE of literature for the plant engineer's library

STANDARD CATALOGS, bulletins and handbooks are listed to help plant engineers maintain a permanent data file. To get these free catalogs, circle item numbers of those wanted on postage-free cards provided on pages 301 and 302.

PACKINGS, SEALS

Cup Packings—Properties and characteristics of Rex-Syn cup packings—a combination of a plastic resin elastomer—are described in this bulletin. Gives standard sizes for Rex-Syn and outlines results of field tests. E. F. Houghton & Co.

▲ For a copy, circle 301 on Post Card

Piston Packing—Sixteen-pp Bulletin 5903 presents engineering data on Darcova Pumcups for packing pistons of air cylinders, hydraulic cylinders and reciprocating pumps. Included are operating diagrams and a list of typical installations, as well as helpful data on Pumcup compositions. Darling Valve & Mfg. Co.

▲ For a copy, circle 302 on Post Card

Mechanical Packings—Featured in 24-pp Catalog 56 are several recent packing developments including the multi-purpose Bel-Vee V-Ring packings, the long wearing crisscross braid packing series, twisted foil packings for oil and distillate temperatures to 1000 F, and an Inconel-wire reinforced plastic packing for valves handling superheated steam at temperatures up to 800 C. The Belmont Packing & Rubber Co.

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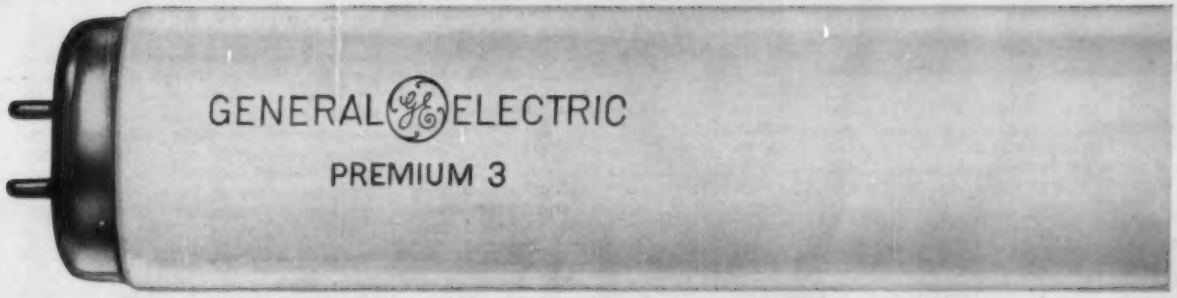
50% MORE LIGHT

FROM ANY 2-YEAR OLD 40-WATT SYSTEM



New G-E Premium 3 Fluorescents. If your present 40-watt fluorescents are two years old or more, you can probably boost your lighting level by 30% to 50%—overnight—without spending a single capital expense dollar! How? By replacing them with new General Electric Premium 3 Lamps. Fact is, you'd gain *at least* as much extra light as your present lamps would deliver if they were a foot longer and used a lot more electricity.

G-E Premium 3 Lamps are new from end to end. New "Wattage Miser" Cathodes that cut wattage loss . . . new, more efficient "Bonus" phosphors . . . improved gas mixture. And like the *standard* 40-watt fluorescents, the F-40, they operate in starter-type *or* Rapid Start circuits. General Electric Premium 3 Lamps are first to deliver over 3,000 lumens . . . giving you more light at the lowest possible cost. For more information, call your G-E Lamp distributor today—or write: General Electric Co., Large Lamp Department C-032, Nela Park, Cleveland 12, Ohio.

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GENERAL ELECTRIC

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DATA FILE

(Begins on page 304)

Molded Packing—Engineering Bulletin K-260 presents technical information on Palmetto Kups, single lip piston seals for hydraulic or pneumatic applications where there is reciprocating motion. Provides specifications and application data, gives recommended uses. A table lists fabric and synthetic composition Kups. Greene, Tweed & Co.

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Mechanical Seal—Performance and design features of Mechanipak PK mechanical seals for a variety of operating conditions are detailed in 8-pp Bulletin AD-150. Cutaway views, diagrams and tables of dimensional data included. Garlock, Inc.

▲ For a copy, circle 305 on Post Card

VALVES, PIPING, FITTINGS

Corrosion-Resistant Valves—Eight-pp Bulletin 7 contains complete engineering specifications for company's corrosion-resistant valves, as well as photos of individual types in the line. Alloy Steel Products Co.

▲ For a copy, circle 307 on Post Card

Ductile Iron Valves—Features and advantages of ductile iron non-lubricated plug valves with Teflon sleeves are detailed in 6-pp Bulletin V/12a. Cutaway view showing component features is included, along with specifications. The Duriron Co., Inc.

▲ For a copy, circle 309 on Post Card

Stainless Steel Valves—Corrosion resistant stainless steel valves are featured in 32-pp Catalog 59SS. Features of design and construction are shown through cutaway views, and advantages of stainless steel in withstanding corrosive chemicals and atmospheres detailed. Jenkins Bros.

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Choosing the Right Valve—Importance of choosing the right valve is stressed in this 20-pp Bulletin AD-2016. Describes three principal valve types—gate, globe and check valves—their design and service characteristics, lists names of valve parts, describes disc-stem connection, bonnet and bonnet-joint characteristics, materials. Crane Co.

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Bronze Gate Valve—Sectional views detail features of company's union bonnet bronze gate valve in Circular 610. Also included is a table of dimensions. Available in sizes ¼- to 2-in. This valve has a double wedge disc, rising stem, is rated 125 lb sp—200 wog. The Lunkenheimer Co.

▲ For a copy, circle 312 on Post Card

Improved Valve—Bulletin 594 describes features and advantages of company's PDQ valve, designed for easy and quick replacement. Cutaway views showing internal details are included, as well as application data. Hunt Valve Co.

▲ For a copy, circle 313 on Post Card

Butterfly Valves—Bulletin 10 contains detailed selection information on a rubber seat butterfly valve designed to mount between pipe flanges. Contains tables of maximum valve line pressures for various cylinder operating pressures, water flow characteristics. Henry Pratt Co.

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Butterfly Valves—Resilient-seated type butterfly valves for applications where positive tight closure is required are illustrated and described in Bulletin 590X. Advantages and outstanding features are detailed. W. S. Rockwell Co.

▲ For a copy, circle 315 on Post Card

Steam Traps—This 1960 Condensed Catalog contains 12-pp of technical details, dimensions, and capacity data on steam traps, temperature regulators, and heating specialties. Cutaway views and diagrams are included. Sarco Co., Inc.

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Manual on Traps—This 40-pp engineering manual is designed to assist in the sizing, specifying and selection of steam traps and other fluid specialties. Includes steam trap selection guide, explanation of four basic types of traps and how they perform their function, four steps to follow in sizing a steam trap, table of factors and detailed instructions on how to select steam traps. The V. D. Anderson Co.

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On Steam Traps—Catalog K is an enlarged 48-pp manual and steam trap catalog. New material provided includes open float and thermostatic traps, pipe strainer to 6 in. steel and semi-steel, and helpful steam pipe sizing tables. Discusses fundamentals of good trapping, trap selection, installation. Armstrong Machine Works.

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Piping Products—Use of this company's couplings, fittings and other piping products is described in 8-pp Form 259. Contains product information, installation instructions, specifications, illustrations of such applications as fuel and supply lines, materials handling piping, equipment piping, pump settings. Dresser Mfg. Div., Dresser Industries, Inc.

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Glass Drainline System—Twelve-pp Bulletin PE-30 describes Pyrex brand drainline system for disposal of corrosive wastes. Contains product and property data, information on making joints and hanging, and list of available fittings, as well as schematic drawings, tables and specifications. Corning Glass Works.

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Fluid Line Coupling—Catalog 100 contains data sheets describing company's line of quick-connective fluid-line couplings for pneumatic, hydraulic, oxygen, acetylene, steam, various gases and liquids service. Dimensions included. The Hansen Mfg. Co.

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Expansion Joints—Twelve-pp Bulletin EJ-1917 describes advantages of company's Gun-Pakt expansion joints with either welding or flanged ends. Section on figuring expansion of pipe lines, expansion joint installation suggestions, and complete specifications included. Yarnall-Waring Co.

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LUBRICANTS

Lubricant Data—Characteristics, advantages of company's line of specialized fluid and grease type lubricants are described in 32-pp Data Book 59-2. Includes sections on control of friction, use of grease type lubricants, proper applications, and recommendations for various operating conditions. Lubriplate Div., Fiske Brothers Refining Co.

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Lithium Base Grease—Featured in this 12-pp booklet is a multi-purpose lithium base grease designed to do the work of many. Characteristics of the grease under different types of conditions given. Gulf Oil Corp.

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MECHANICAL POWER TRANSMISSION

Power Transmission Products—Catalog 759 contains 104-pp of engineering data, specifications and prices on roller chain, sprockets, couplings and conveyor chain. Data includes material on selection of roller chain drives, speed ratios for sprocket combinations, chain length tables, illustrations of various standard attachments. Diamond Chain Co., Inc.

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Planetary Gears—Eight-pp Bulletin 2401 covers company's planetary and star gears, used for boiler and feed and circulating water pump drives, compressor and blower drives, and as drives for turbines and internal engines. Includes cutaway drawings, information on construction details. De Laval Steam Turbine Co.

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Variable Speed Drives—Six-pp Folder 2874 describes constant horsepower variable speed drives to meet capacity demands to 50 hp and ratios to 5.5:1. Discusses features of a twin-strand single roll chain that operates between a pair of smooth facing wheels to change ratio and output shaft speed as effective diameter of wheel faces is altered. Link-Belt Co.

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Grommet V-Belts—Advantages of company's grommet V-belts are illustrated and described in this 8-pp bulletin. Belt features are fully described, and a section on how to figure a V-belt drive is included. Goodall Rubber Co.

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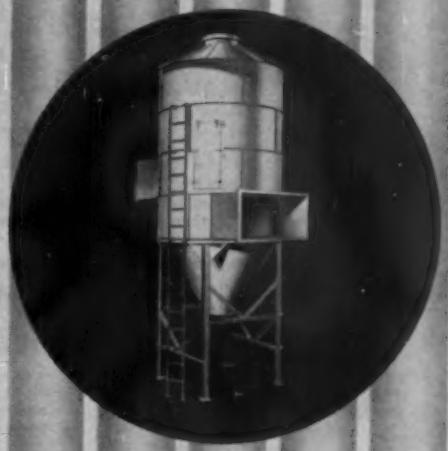
Frequency-Controlled Speeds—Illustrated with schematic drawings and application photos, 8-pp Bulletin F-1963 explains company's Varidyne principle whereby any a-c motor is converted to variable speeds by varying frequency of a-c supplied to motor (or motors, in a multi-motor

NEW!
AAF TUBE FILTER



Combines maximum air cleaning with minimum maintenance

The new AAF Tube Filter is made to order for ventilation systems requiring a high degree of air filtration combined with minimum maintenance. This new unit offers simple disposal of collected dust and simplified design for easy field assembly.

Typical applications are steel mill motor rooms, sewage treatment plants, instrument rooms and paint spray facilities.

This new AAF filter utilizes a fibrous media supplement inside the cloth tube as the collecting medium. The fibrous material is held against the cloth by the air stream. Infrequent maintenance on the filter is accomplished by operating a mechanical shaker mechanism after the fan has been shut down. Re-charging the tubes with media supplement requires only a few minutes.

The AAF Tube Filter is available in circular or rectangular housings or can be designed to fit a given space.

For complete product information, call your local AAF representative or write direct for AAF Tube Filter Bulletin No. 222. Address: Mr. Robert Moore, American Air Filter Company, Inc., 228 Central Avenue, Louisville, Kentucky.

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For more facts circle 691 on Reply Card

DATA FILE

(Begins on page 304)

application). Describes power unit used. U. S. Electrical Motors, Inc.

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Variable Speed Belts—Detailed information on company's variable speed belts made with arched construction for improved transverse rigidity is presented in Product Bulletin 862. The Goodyear Tire & Rubber Co.

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Anti-Friction Bearings—Catalog 424-B covering "the broadest line in the anti-friction field," is an 8-pp folder giving capsule presentation of company's entire product line. A brief description of each product is provided. SKF Industries, Inc.

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Spring Clutches—Described in this 30-pp catalog are five standard lines of spring clutches in bore sizes from ⅛ to 1 in., torque capacity to 1250 lb-in., for use in applications utilizing drive up to 5 hp. Clutches offered include over-running and back-stopping; indexing; on-off; on-off indexing; and safety lock control. Marquette Div., Curtiss-Wright Corp.

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More Flexible Couplings—An expanded line of Para-flex cushion couplings, from fractional to 190 hp per 100 rpm, is described in 12-pp Bulletin A669C. Of two new sizes included in the line is one capable of delivering 2000 hp at 1080 rpm. Photos, drawing and text explain design features and operating characteristics of Para-flex. Dodge Mfg. Corp.

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Flexible Couplings—Comprehensive selection data on flexible couplings is presented in 48-pp Engineering Catalog 60. Misalignment is described and basic coupling arrangements and load classifications are included, along with photos of couplings, etc. Thomas Flexible Coupling Co.

For a copy, circle 336 on Post Card

HOSE, FITTINGS

Improved Pressure Hose—Form NEPR-500, 24-pp, describes Hytron hose and couplings. A section on engineering facts on this hose covers its advantages, applications, limitations. Booklet also gives tips on installation, chemical resistance tables, temperature and pressure ranges. The Imperial Brass Mfg. Co.

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Teflon Hose Assembly—Advantages of company's Springfield 120 Teflon hose assembly are detailed in this illustrated bulletin. Assembly procedure is pictured and described and design specifications tabulated. Titeflex, Inc.

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Flexible Metal Hose—Featured in 8-pp Catalog 188 is a line of flexible metal hose, as well as rubber and synthetic hose. Detailed specifications and dimensions given. Flexonics Corp.

For a copy, circle 339 on Post Card

FANS, VENTILATING AND AIR CONDITIONING

Industrial Fans—Bulletin 690-A, 12-pp, contains dimensions and application and performance data on direct connected fans for general and system ventilation and power roof ventilators, air deliveries to 103,200 cfm. Propellair Div., Robbins & Meyers, Inc.

For a copy, circle 340 on Post Card

Ready Units—Catalog 517 provides 36-pp on complete, ready-to-run centrifugal fan equipment. Capacities 400 to 13,000 cfm, belt and direct driven units. Clarage Fan Co.

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Propeller Fans—Catalog DB1-100, 20-pp, describes in detail company's direct-drive self-cooled motor propeller fans, including: high and low speed units, explosion proof and tube-axial type, sizes from 6- to 48-in., capacities from 250 to 27100 cfm. Dimensions, accessories and tables showing recommended air changes included. Ilg Electric Ventilating Co.

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Air Moving Equipment—Bulletin DB 45, 20-pp, contains detailed information on company's line of roof ventilators, bifurcators, axial flow vent sets, and air jets. Bonded performance ratings are listed on tables, and dimensional data included. De-Bothezat Fans Div., American Machine and Metals, Inc.

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Centrifugal Roof Exhausters—Bulletin 60-CK describes centrifugal power roof exhausters featuring reduction in overall exhauster height. Air moving capacities for 141 models are given, along with dimensional and curb mounting drawings, electrical characteristics and optional accessories. Jenn-Air Products Co., Inc.

For a copy, circle 345 on Post Card

For Air Conditioning—Featured in 8-pp Bulletin S-290 is company's line of products for air conditioning, as well as products for heating, ventilating and heat transfer. Installations shown. The Trane Co.

For a copy, circle 346 on Post Card

Air Conditioning Units—Bulletin 786 contains 54-pp of selection data on air conditioners, including capacities, standard arrangements, dimensions, etc. Steps in selection of basic unit and components are outlined. First pages are devoted to choosing physical size based on air capacity and face velocity requirements. Succeeding pages concern themselves with heating and cooling requirements. American Air Filter Co., Inc.

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Zone Control Cabinets—Air conditioning zone control cabinets are described and illustrated in 20-pp Bulletin AC-220. Separate sections with tables, curves and sketches cover proper unit selection, physical data, dimensions. Buffalo Forge Co.

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INSULATION, PROTECTION

Duct Insulation—Thermal and acoustical duct insulation made of long textile-type glass fiber is illustrated and described in this 8-pp Bulletin ULD-859. Includes detailed application specifications, data on characteristics of the duct liners, thermal efficiencies, sound absorption data. Gustin-Bacon Mfg. Co.

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Building Insulation—Twenty-pp Booklet FB-105 contains descriptive information on uses of cellular glass insulation on roofs, parking decks, core walls, wall linings, curtain walls, perimeters and ceilings. It contains drawings and specifications for typical applications, as well as technical data. Pittsburgh Corning Corp.

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Flexible Pipe Insulation—This bulletin describes Armaflex 22, a flexible foamed plastic insulation for piping. Gives advantages, physical properties, thickness recommendations and sizes. Tells how to apply it to new or existing piping and fittings. Armstrong Cork Co.

For a copy, circle 351 on Post Card

For Insulation Protection—Comprehensive data on mastics, coatings, adhesives, and flashing compounds for thermal insulation has been classified as to industry usage—power, process, cold storage, marine and commercial—in this ready-reference loose-leaf manual, about 208-pp. Detailed application information and product data is included, as well as illustrations of uses. Benjamin Foster Co.

For a copy, circle 352 on Post Card

CONSTRUCTION

Open Web Joists—Standard and long span open web steel joists are illustrated and described in this 38-pp catalog. Advantages of the steel joist construction are detailed, and sections are included on design calculation, properties and dimensions. American Bridge Div., United States Steel Corp.

For a copy, circle 353 on Post Card

Structural Clay Products—Descriptive information, photos and construction details on structural clay building materials are presented in 24-pp Catalog S-60. Characteristics and advantages of various types of facing tile, bricks, and other products are detailed. Natco Corp.

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Decorative Protective Panels—Advantages of Security Panel, a combination of steel mesh and polyester resin translucent panels, are detailed in this bulletin. It features high dimensional stability, high impact strength and protective functions. Installation and technical information are covered. Resolite Corp.

For a copy, circle 357 on Post Card

Expanded Metal Reinforcing—Characteristics and advantages of expanded metal reinforcing for concrete are detailed in 16-pp Form WC-122. Design data tables for selection of proper unit stresses for concrete included. Wheeling Corrugating Co.

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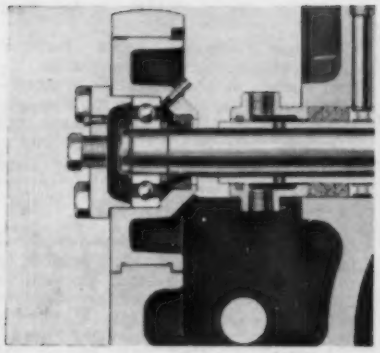
PUMPAGE

Goulds news about pumps for process industries



When life hangs by 5/1000 of an inch

Whether life is long or short depends on the proper fit of shaft to bearing. Destroy the fit by 5 to 10 thousandths of an inch—and you shorten bearing life. Therefore Goulds pump shafts are ground and polished to within the tolerances specified by bearing manufacturers. To insure complete accuracy, bearing housings are bored by a special machine. Careful handling when removing and replacing bearings in the field will also go a long way toward protecting fit and helping bearings live to a ripe old age.

Now... ISO-40 to guard against corrosion and abrasion

A stainless of great strength, ISO-40* alloy survives under some very harsh conditions. Strongly oxidizing nitric solutions don't faze it. It's a match for 50% sulfuric at r.t. It resists corrosion, abrasion, high shock. Can be furnished with a B.H.N. hardness of 320, tensile strength of 145,000 psi. A pump with an ISO-40 impeller circulated a slurry of sodium sulfite and sodium carbonate for 17 months with negligible impeller damage. Speaking of pumps, did you know you can get Goulds chemical pumps in ISO-40?

*Registered trademark of Empire Steel Castings, Inc.

Circulating crude phthalic anhydride

One company does it with two Goulds Model 3171's. Each delivers forty gallons a minute of this sluggish solid (sp. gr. 1.2) from a depth of 11 ft. at temperatures from 300 to 525 F. How? The discharge pipe, which extends from pump through pit cover, wears a steam jacket. Temperature stays up—phthalic anhydride stays fluid. The long pipe has a 3″ expansion joint. Additional steam-jacketed pumps of other and varying lengths give flexibility to the installation. For details on how Goulds Model 3171's can help *you* move uncooperative solids, write for Bulletin 726.2.

Nuclear nomad of the seven seas

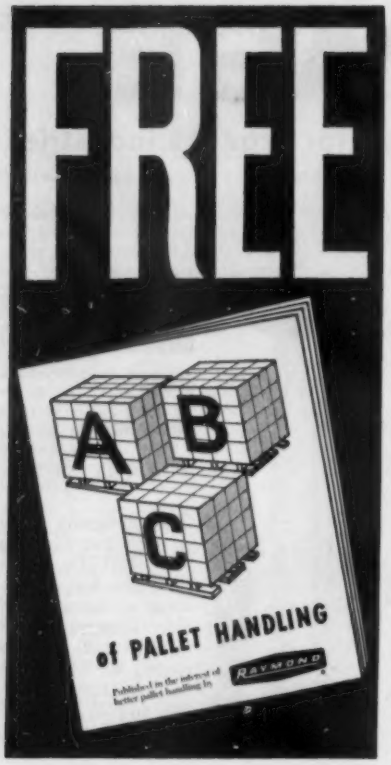
N. S. Savannah, first atomic-powered merchantman, will call at the seaports of the world as a symbol of the peaceful use of nuclear power. The 21,800-ton ship has a practically foolproof power plant. Its pressurized-water nuclear reactor uses uranium oxide fuel. Goulds Model 3655 (close-coupled centrifugal) pumps the radioactive waste water on both bilge and ballast service. The Model 3655 is available in 23 sizes with capacities to 2000 gpm, heads to 400 ft. Pump and motor are a single, compact unit, easy to install and ready to run. Standardization of parts holds down inventories. For full details, including specifications, construction information and performance charts, write for Bulletin 710.1.

NEW "king-size" vertical... capacities to 3180 gpm

Here are all the details on Goulds newest heavy-duty centrifugal sump and process pump—the "L" size Model 3171. Unit available in 316 stainless and other special alloys. Specifications, sectional views, construction materials, performance curves, dimensions—all are clearly given in Bulletin 726.2. For your copy, write Goulds Pumps, Inc., Dept.PE-100,Seneca Falls, N. Y.

GOULDS PUMPS

For more facts circle 692 on Reply Card



The ABC's of pallet handling digested into a new and useful "how to" handbook. Contains practical information: how to select, load and handle pallets; how to estimate pallet requirements; step-by-step load pattern diagrams; how to increase warehouse capacity up to 50%; facts about the RAYMOND trucks that made narrow aisles possible. Send for your personal copy plus extras for your organization, clip coupon to letterhead and mail today.

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DATA FILE

(Begins on page 304)

Screw Fastening of Aluminum—This 48-pp technical handbook covers various types of standard and special fasteners and fastening systems used to join aluminum assemblies. Supplemented with numerous illustrations and tables, it includes list of manufacturers of special screw fasteners and recommended hole sizes for various types of self-tapping screws. Reynolds Metals Co.

For a copy, circle 359 on Post Card

Structural Glass—Catalog 60-I contains essential data on company's line of rolled, figured and wired glass for a variety of industrial applications. Advantages and important functions are described, and light distribution tables and specifications are included. Mississippi Glass Co.

For a copy, circle 360 on Post Card

Acrylic Plastic Sheet—This 12-pp Booklet PL-415 describes properties and characteristics of Plexiglas acrylic plastic sheet. Applications in a variety of industries are illustrated, and advantages detailed. Rohm & Haas Co.

For a copy, circle 361 on Post Card

Basic-Roofing Information—"What You Should Know About Your Roof" is a 40-pp clearly illustrated booklet which tells what makes a roof fail, how to recognize signs of roof deterioration, what to do to keep a roof in good condition. Discusses roofing practices. Johns-Manville.

For a copy, circle 362 on Post Card

Automatic Door Assemblies—Eight-pp Catalog 171 describes features and advantages of company's automatic industrial doors and assemblies. Photos of typical installations and sectional diagrams showing details of operation and design are included. Clark Door Co., Inc.

For a copy, circle 363 on Post Card

Grating and Treads—Safety, visibility, permanence and easy maintenance are among advantages of open flooring discussed in 28-pp Bulletin 2527-R. Covers use of electro-forged grating in a wide range of industries also features grating applications. Information provided includes types and spacing, bearing bar surfaces and weights, fastening methods, and safe loads. Blaw-Knox Co.

For a copy, circle 365 on Post Card

Gratings and Treads—Bulletin 1110, 24-pp, describes welded, serrated, pressure-locked, steel, vault, platform and aluminum grating in standard and close spacing types. Stair treads are also shown. Provides tread weights, and ordering instructions. Safe loads also given. Dravo Corp.

For a copy, circle 366 on Post Card

Steel Floor Plate—Features and advantages of rolled steel floor plate are detailed in this Product Form 3184. Table of dimensional data is included, as well as illustrations of installations. Alan Wood Steel Co.

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WATER TREATING

Consulting Service—Advantages of company's consulting service are detailed in 8-pp Bulletin 5006-A. How the service is qualified to solve problems concerning scale and corrosion control in boilers, cooling systems, and process waters is discussed. Dearborn Chemical Co.

For a copy, circle 368 on Post Card

Corrosion Control—Process Bulletin B6 discusses causes of condensate system corrosion and methods of corrosion control in steam condensate systems. Condensate corrosion inhibitors are described. Nalco Chemical Co.

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MAINTENANCE

Corrosion Control Systems—This booklet is designed as a guide to primary protection and preventive maintenance of all metal surfaces subjected to chemical attack of acids and alkalis, fumes and gases, active industrial solvents and severe industrial weathering. Principal protective systems are described and properties listed. Truscon Laboratories, Devoe & Raynolds Co., Inc.

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Coatings for Industry—Detailed information on a variety of coatings for industrial application, including anti-corrosive coatings, decorative finishes, exterior wall and roof coatings, floor materials, fungus and mold treatments, industrial coatings, interior wall coatings, roof coatings and other products, is presented in 40-pp Catalog 59. Properties and application details covered. Steelcote Mfg. Co.

For a copy, circle 371 on Post Card

Painting Economy—This 12-pp guide to economical maintenance painting is designed to help reduce cost of painting in industrial, institutional and commercial buildings. Outlines three basic areas of painting economy. Barreled Sunlight Paint Co.

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Corrosion-Resistant Coatings—Bulletin 100 contains a table listing protective coatings for corrosive classifications. Description and general use of various types of coatings, performance and application information, and chemical resistance ratings are given. Carboline Co.

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Coating Systems—Described in this 16-pp bulletin are a number of protective maintenance coating systems designed to solve a variety of corrosion problems. Index tab indicates where a particular system should be applied, and copy explains features of each system. The Glidden Co.

For a copy, circle 374 on Post Card

Masonry Cleaner—Properties and advantages of a dry-powder masonry cleaner are detailed in Circular 55. Includes tips on mixing and using the masonry cleaner. Standard Dry Wall Products, Inc.

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Floor Maintenance—Many types of industrial floors are studied and their

Over 1,000,000 Americans cured of cancer! Enough to fill the famous Rose Bowl ten times over. **All** of them alive and well because five, ten or even twenty years ago they went to their doctors in time.

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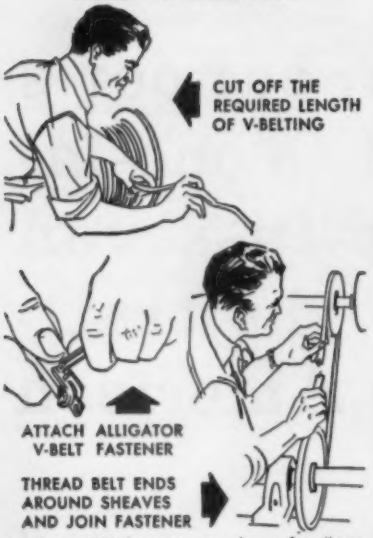
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DATA FILE

(Begins on page 304)

soil removal problem analyzed in this 8-pp booklet, complete with charts, list of cleaning compounds, and descriptions of cleaning methods. Methods of sanitizing, stripping wax and paint, and of absorbing liquids told. Oakite Products, Inc.

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Industrial Vacuum Units—This bulletin describes heavy-duty vacuum units, both portable and stationary, designed to reclaim, process and convey many types of materials, as well as remove dirt, litter. Among applications covered are machine sump cleaning, removing press punchings, cleaning boilers, and conveying of plastic pellets. Invincible Vacuum Cleaner Mfg. Co.

For a copy, circle 377 on Post Card

Electric Power Sweeper—Cleanliness, quietness and other advantages of this battery-powered sweeper are detailed in Bulletin 85.46. Mechanical data and photos of applications included. G. H. Tennant Co.

For a copy, circle 378 on Post Card

SAFETY, SANITATION

Fire-Resistant Fluids—This series of specification sheets describes company's line of fire-resistant fluids including synthetic, oil-water emulsion and glycol types. Physical characteristics given. Mobil Oil Co., Inc.

For a copy, circle 379 on Post Card

Handling Flammable Liquids—Problems involved in the use of flammables in individual processes, and methods and equipment required for safe control are described in this 76-pp safety handbook. Physical properties and characteristics of most commonly used flammables are detailed; recommendations for safe handling given. The Protectoseal Co.

For a copy, circle 380 on Post Card

Special Fire Protection—Devoted to special fire protection, this 44-pp booklet covers both equipment and methods. Tells how to recognize special fire-hazards conditions in a plant. Discusses in detail major types of fire protection, telling how each functions, giving its advantages and limitations, and illustrating some examples of successful use. Grinnell Co., Inc.

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Control of Dermatitis—Preventive measures to be taken against industrial dermatitis are fully detailed in this 26-pp illustrated bulletin. Included is a breakdown of industrial skin diseases by representative industries and the preventive measures that can be taken. A list of protective creams, soaps, disinfecting systems, and other preventive measures given. West Chemical Products Inc.

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Skin Cleansers—Described in this product bulletin is a line of scientifically formulated skin cleansers for industrial use. Advantages of various cleansers are detailed. Sugar Beet Products Co.

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INSTRUMENTS, CONTROLS

Analog Computer Control—Complete details on company's solid state analog computer control systems are presented in 6-pp Bulletin MSP-163. Describes solid state controllers with operational magnetic amplifiers, interchangeable components. Hagan Chemicals & Controls, Inc.

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Gages, Needle Valves—Catalog 76-G consists of a loose-leaf bound collection of literature on gages and needle valves. Various types of gages are illustrated and described, with applications and specifications fully detailed. Jas. P. Marsh Corp.

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Meters, Regulators, and Valves—Bulletin C-5000, 28-pp, describes and illustrates meters, regulators and valves for a wide range of services. They include gas meters, gas pressure regulators, industrial meters, water meters. Information includes application suggestions, specifications and references to more detailed product literature. Rockwell Mfg. Co.

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Sound Measuring Equipment—Bulletin 797-E contains 16 pp of detailed information on a line of sound-meas-

NEW!

REGULATORS AND CONTROL VALVES NOW AVAILABLE IN DUCTILE IRON

This easy to use manual describes how you can get steel strength in regulators and control valves at the cost of iron . . . and, at considerable savings. It fully explains how ductile iron is produced, shows features, specifications, typical ranges of mechanical properties, and comparison tables on physical properties of cast steel, ductile iron, red brass and cast iron. This manual is also a condensed catalog describing the complete line of OPW-JORDAN products that are available to you in ductile iron. DI-1

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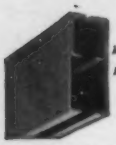

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Inquiries from your engineers or consultants welcomed.

COLUMBUS McKINNON CORPORATION

Conveyor Division

TONAWANDA, N. Y.

For more facts circle 698 on Reply Card

DATA FILE

(Begins on page 304)

uring equipment, including sound-level meters, vibration meters, analyzers and accessories. Typical applications in a variety of industries shown. General Radio Co.

▲ For a copy circle 387 on Post Card

Malfunction Detector—Technical Bulletin RF-586 describes a malfunction detector designed to provide maximum protection for large motors, pumps, compressors and other rotating equipment by responding to mechanical malfunctions the instant they occur. Aeronautical and Instrument Div., Robertshaw-Fulton Controls Co.

▲ For a copy circle 388 on Post Card

Explosion-Proof Controls—Advantages of company's explosion-proof controls, indicating, non-indicating and recording, are detailed in this product bulletin. Design features and ratings given. The Partlow Corp.

▲ For a copy circle 389 on Post Card

Tank Contents Gaging—Bulletin 463A describes a line of remote and direct reading tank contents gaging systems, including hydrostatic, hydraulic and direct reading gages. Details on operation are illustrated. The Liquidometer Corp.

▲ For a copy circle 390 on Post Card

SLINGS, CHAINS, WIRE ROPE AND FITTINGS

Wire Rope Requirements—General wire rope recommendations for equipment most commonly used by a wide variety of industries are listed in Service Bulletin 107. Gives constructions most suitable for specific types of equipment and jobs. Leschen Wire Rope Div., H. K. Porter Co., Inc.

▲ For a copy circle 391 on Post Card

Drop Forged Fittings—Comprehensive data on company's line of drop forged fittings for wire rope and chain are presented in 40-pp Catalog 950-2. Includes specifications, dimensions, rated capacities and weights. Crosby-Laughlin Div., American Hoist and Derrick Co.

▲ For a copy circle 392 on Post Card

MATERIALS HANDLING

Conveyor System—Construction and operating features of company's Power-Flex and free conveyor system for industry-wide application are illustrated and described in 6-pp Bulletin 159. Advantages are detailed and general specifications given. Conveyor Div., Columbus McKinnon Corp.

▲ For a copy circle 393 on Post Card

Continuous Power Conveyor—Sixteen-pp Catalog A-96-R describes a packaged overhead conveyor for light duty applications. Describes components and discusses lubrication and chain safeguards. Suggested layouts are diagrammed and installations shown. Richards-Wilcox Mfg. Co.

▲ For a copy circle 394 on Post Card

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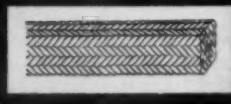
NEW PALMETTO® Teflon* Filament Packing



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NORTH WALES, PA

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LESCHEN WIRE PORTER ROPE DIVISION

H. K. PORTER COMPANY, INC.

For more facts circle 700 on Reply Card

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PAGE'S new ACCO-*Aluminized* chain link fabric is a superior product that means plus value for you. The strong steel wire has a bonded coat of commercially-pure aluminum. Result? Definitely, **QUALITY.** ACCO-*Aluminized* has the strength of steel plus aluminum's longer-lasting non-corrosive qualities.

WIDE CHOICE is important. In addition to ACCO-*Aluminized*, we offer a choice of other quality fabrics—galvanized steel, stainless or solid aluminum. Each of these has characteristics to better meet your climatic or service conditions. Also, there are 8 basic fence designs and 6 gate styles. No other company can serve you with so wide a selection.

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Helpful booklet describes fence styles, gates and components

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A product of Page Steel & Wire Division American Chain & Cable Co., Inc.

For more facts circle 701 on Reply Card

On Spiral Conveyors—Described in 60-pp Catalog 951 are spiral conveyors and fittings for meeting practically any requirement and operating conditions. Four principal types—helicoid, sectional flight, ribbon flight, and cast iron—are listed along with special types. Selection tables list materials which can be effectively handled. The Jeffrey Mfg. Co.

For a copy circle 395 on Post Card

Vibrating Conveyors—Advantages and features of vibrating conveyors are detailed in 16-pp Catalog 66. Layouts and flow charts showing how conveyors can be designed to perform a wide variety of processing operations at the same time the material is being conveyed are included. Ajax Flexible Coupling Co., Inc.

For a card circle 396 on Post Card

Live Roller Conveyor—Form 1250 explains and illustrates principles of adjustable pressure conveyor operation and their application to live roller conveyors. Also shows typical applications. Tells types of materials and containers handled. The Rapids-Standard Co., Inc.

For a copy circle 397 on Post Card

Continuous Vertical Conveyor—Bulletin 125 describes features and advantages of the Escaveyor, a continuous vertical conveyor designed to speed lifting and lowering. Schematic diagrams suggest some of the conveyor systems, for both horizontal and vertical continuous flow, that can be made from the units. Standard Conveyor Co.

For a copy circle 398 on Post Card

Crane Control—Bulletin 9100 contains 20-pp of selection and application information on a crane control for hoist, bridge and trolley service. Performance curves, schematic diagrams, dimensional data, reference tables and suggested specifications are included. The Clark Controller Co.

For a copy circle 399 on Post Card

Countersinking Belt Fasteners—Bulletin F-115 describes a method of countersinking fasteners in heavy conveyor belt covers. Various types of countersinking tools are illustrated. Flexible Steel Lacing Co.

For a copy circle 400 on Post Card

Vertical Transportation—Selection of vertical transportation for every traffic-moving job is detailed in 32-pp Bulletin A-382. Various types of elevators and escalators for a variety of commercial and industrial applications are described. Otis Elevator Co.

For a copy circle 401 on Post Card

Mechanical Jacks—Mechanical Catalog 60 contains 16 pp of information on mechanical jacks and pullers, including ratchet lowering lever jacks, track jacks, journal, bridge, screw, push-and-pull jacks, special purpose equipment, accessories. Includes specifications. Templeton, Kenly and Co.

For a copy circle 402 on Post Card

Load Handling Equipment—Illustrated and described in 20-pp Bulletin 15025 is load handling equipment, including portable electric hoists, I-

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2453

24th NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

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NEW YORK COLISEUM
NOV. 28—DEC. 2, 1960

MANAGEMENT: INTERNATIONAL EXPOSITION COMPANY
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For more facts circle 703 on Reply Card

DATA FILE

(Begins on page 304)

beam trolleys, differential chain hoist, trolley hoists, lever-operated hoists, electric hoists, driven trolleys, air hoists, jib assemblies and bridge cranes. Detailed specifications given. Manning, Maxwell & Moore, Inc.

▲ For a copy circle 403 on Post Card

Sheet and Coil-Lifters—Bulletin SL-30, 16-pp, illustrates and describes various types of standard and semi-special lifters for one-man or automatic handling of sheet and coil stock. Advantages and design features are detailed. Cullen-Friestedt Co.

▲ For a copy circle 404 on Post Card

Heavy Duty Hoist—Bulletin 142-H, 26 pp, describes the Meteor wire rope electric hoist with single- or two-speed control. Discusses suspension types, trolleys, available accessories. Specifications, clearance diagrams, prices. Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp.

▲ For a copy circle 406 on Post Card

Electric Hoists—Twelve-pp Bulletin DH 133D describes Speedway electric hoists of 500-to 4000-lb capacities. Fully illustrates and explains design features and gives details on supensions and conducting systems. Clearance data given. Wright Hoist Div., American Chain & Cable Co., Inc.

▲ For a copy circle 407 on Post Card

Industrial Truck Costs—A library of information on figuring industrial truck costs is presented in four recently published bulletins—62 pp in all. Includes factual industrial truck cost histories and do-it-yourself formulas for quick, accurate calculation and comparison of all expenditures in owning, operating and maintaining trucks powered by electricity, gasoline, propane. Exide Industrial Div., The Electric Storage Battery Co.

▲ For a copy circle 408 on Post Card

For Materials Handling—Specifications and illustrations on two-wheel trucks, dollies, wagon trucks, platform and shelf trucks, and many styles of casters, jacks and semi-live skids are given in 12-pp Bulletin 59G. Also included are specifications on demountable rubber tired, plastic, and pneumatic wheels. Nutting Truck and Caster Co.

▲ For a copy circle 409 on Post Card

Cost-Cutting Materials Handling—"The How Book of Cost-Cutting Materials Handling," is a 24-pp booklet covering various phases of the materials handling problem and their effect on industrial production. Text and pictures cover such subjects as fundamental handling motions, advantages of planned material handling practices. The Yale & Towne Mfg. Co.

▲ For a copy circle 410 on Post Card

MH Equipment Selector—Sixteen-pp Condensed Catalog 80-204 describes and illustrates manufacturer's line of materials handling equipment. Offers specifications and illustrations on

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For more facts circle 704 on Reply Card

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rider fork lift trucks, rider tractors, narrow aisle rider electrics, electric powered walkies and manual equipment. A selector chart shows types. Lewis-Shepard Products Inc.

For a copy circle 411 on Post Card

Industrial Casters—Catalog 159 contains 24-pp of illustrations, descriptions and specification data on swivel-plate and rigid-plate truck casters for industrial applications. Includes detailed information on spring-action casters, V-groved casters, grease-sealed casters, scaffold casters, floor truck locks, industrial wheels, and others. Faultless Caster Corp.

For a copy circle 412 on Post Card

Self-Dumping Hoppers—Cost-saving advantages of self-dumping steel hoppers for bulk material handling are detailed in Bulletin 265. Photos showing typical handling applications are included. Roura Iron Works, Inc.

For a copy circle 413 on Post Card

STORAGE, SHOP EQUIPMENT

Guide to Shelving—To assist plant engineers in selecting proper shelving for all storage requirements. 64-pp Catalog 30 offers detailed suggestions for correct shelving and storing materials, loose and packed parts. Storage cabinets are also described and instructions included for planning of stockrooms. Deluxe Metal Products Co., Royal Metal Mfg. Co.

For a copy circle 414 on Post Card

Storage Racks—Bulletin R-400, 12-pp, illustrates and describes a wide variety of storage racks manufactured by the company. Application drawings, photos and diagrams are included. Chicago Tramrail Corp.

For a copy circle 415 on Post Card

Steel Equipment—Catalog 100 H contains 92-pp of detailed information on steel cabinets, folding chairs, work benches, tool stands, shelving, tool storage, lockers, coat racks, filing cabinets, revolving bins, others. Includes dimensions and specifications. Lyon Metal Products, Inc.

For a copy circle 416 on Post Card

Flexible Steel Shelving—Advantages of Erectomatic steel shelving are illustrated and described in 8-pp Form 2451-D. Various types of shelving available are shown and dimensional data given. Columbia-Hallowell Div., Standard Pressed Steel Co.

For a copy circle 417 on Post Card

TOOLS, WELDING AND MACHINE SHOP

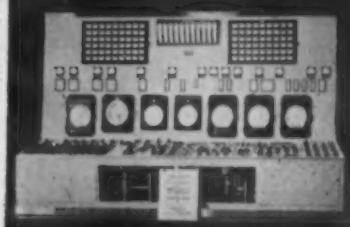
Power Tools—Presented in this 64-pp 1960 catalog is manufacturer's line of power tools for industrial production, plant maintenance, construction, wood and metalworking and other uses. Saws and accessories, hammers, planes, routers, sanders, drills, drivers, wrenches, shears, polishers, grinders and abrasive products are included. Skil Corp.

For a copy circle 418 on Post Card

Masonry Bits—Catalog M B C-56 describes carbide-tipped masonry bits for drilling holes in tile, brick, con-

WHAT COMES UNDER

ENERGY CONTROL?



On paper it's just a phrase, but at work with you and your company it's important. Everything from fuel savings to calculating nuclear fuel costs comes under the heading of "energy control"—a subject of profit to you and your company.

Constant changes in the field make it imperative that you see such exhibits at the Power Show as temperature controllers, pressure and draft controls, liquid heat controllers and many others—PLUS a broad line of other power and allied equipment.

Only at the Power Show do you have the opportunity to investigate, compare and get the right answers, face-to-face, from the manufacturers themselves. Only at the Power Show can you see over 250 leading suppliers' products, all conveniently grouped together at one time.

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24th NATIONAL EXPOSITION OF POWER & MECHANICAL ENGINEERING

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NOV. 28—DEC. 2, 1960

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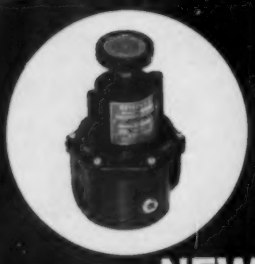

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For more facts circle 707 on Reply Card

DATA FILE

(Begins on page 304)

crete, granite or any other kind of masonry. Specifications are included as well as a table giving chuck and shank requirements to adapt to different hammers. New England Carbide Tool Co., Inc.

▲ For a copy circle 419 on Post Card

Fastening Tool—Illustrated and described in Catalog Form B-141 is the Duo-Jobmaster—designed to handle the tough fastening jobs into steel or concrete. Features and advantages detailed. Ramset Div., Olin Mathieson Chemical Corp.

▲ For a copy circle 420 on Post Card

Pipe Tools—Ordering and application information on Rigid pipe tools is provided in 16-pp illustrated Catalog 7596R-6. Wrenches, cutters, threaders, reamers, vises, and others are pictured and described, also power drives. The Ridge Tool Co.

▲ For a copy circle 421 on Post Card

Welding Equipment—Twelve-pp Bulletin W-158 features a line of transformer, rectifier and rotary d-c welders for a variety of industrial requirements. Detailed specifications and dimensional data are included. Harnischfeger Corp.

▲ For a copy circle 422 on Post Card

Data for the Shop—"Fluids and Facts for Metal Working" is a pocket-size booklet of about 44-pp. A section on metal working fluids covers their function and selection, preparation and use of soluble oil and paste compounds, and prevention of dermatitis. Conversion tables, steel numbering systems, machinability ratings. Standard Oil Co. (Ind.)

▲ For a copy circle 423 on Post Card

LIGHTING, COMMUNICATION

Lighting Units—Design and performance advantages of Wide-Life units for use with color-corrected mercury vapor lamps are detailed in this product Bulletin 405. Typical candlepower distribution curves are included. Wide-Lite Corp.

▲ For a copy circle 424 on Post Card

Fixtures for Industry—Details of the CFI—comfort for industry—the uplight fluorescent lighting fixtures are covered in Form OD-1022, 16-pp. Typical installations, comparisons, size and types, and specifications are included. Day-Brite Lighting, Inc.

▲ For a copy circle 425 on Post Card

Lamp Annunciators—Outstanding features, operation, indications, mounting, relay cabinet (types, dimensions) relay plug-ins (operational sequences, types) audible signals (bells, buzzers, horns) and ordering information are covered in this 24-pp Bulletin 6041. Drawings, pictures and engraving data are included. Edwards Co., Inc.

▲ For a copy circle 426 on Post Card

Group Relamping Plan—Eight-pp Booklet A-6832 describes a group relamping plan designed to reduce costs, provide better lighting, and cause fewer work interruptions. Sample calculations provide data for setting up a relamping schedule. Westinghouse Electric Corp.

▲ For a copy circle 427 on Post Card

Modern Lighting Needs—"Footcandles in Modern Lighting," is a 20-pp revised booklet giving lighting level recommendations for seeing tasks involved in hundreds of industrial and other activities. Figures are based on findings of Illuminating Engineering Research Institute and Illuminating Engineering Society. Also discussed are other aspects of lighting to be considered. General Electric Co.

▲ For a copy circle 428 on Post Card

Lighting Maintenance Tips—Principles and advantages of good lighting practice are presented in this 48-pp lighting maintenance manual. Much useful information has been added to this revised edition, including a guide to trouble shooting fluorescent instal-

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Excellent opportunity for a man with experience in estimating construction and remodeling work. Must be a graduate engineer and a registered Professional Engineer. Should have at least 12 years experience in estimating all types of work, with a working knowledge of unit costs in the general construction trades and in the mechanical and electrical fields. Excellent retirement and insurance benefits. All replies held confidential. Send resume, including academic background, positions held, references, and salary requirements to Mr. L. C. Stephens, Personnel Department, Ohio State University, 190 N. Oval Drive, Columbus 10, Ohio.

NEW G-E OUTLET "LOOKS AHEAD" TO PROTECT YOU FROM ELECTRICAL OBSOLESCENCE

Provides two 20A branch circuits at one outlet for the new heavier-duty 120V appliances and equipment. You just remove one or two breakoffs in this GE4108 De Luxe Grounding Outlet—to get two 20A branches from either a 3-wire, 120/240V service or from separate 120V circuits.

Provides the extra safety of grounding — takes the 20A and 15A grounding caps being put on more and more equipment. Takes polarized-parallel or ordinary parallel-pronged caps, too.

Use No. GE4108 wherever you want a heavy-duty 120V outlet that will meet tomorrow's needs as well as today's. You get 8 back-wired pressure-clamp connections plus 2 grounding terminals to simplify "through" wiring installations. Available in ivory or brown; 20A, 120V; U.L. — listed, meets Federal and REA specifications. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

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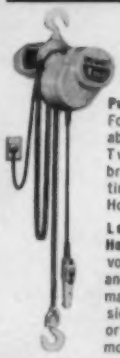
For more facts circle 708 on Reply Card

CUT YOUR COSTS

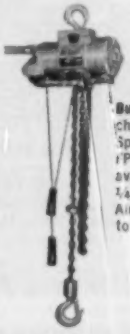
. . . let us help you save on every hoisting operation



ELECTRIC HOISTS

Push Button Budgit Electric Hoist. For regular hoisting service. Portable. Hang up, plug in, and use. Two fully enclosed automatic brakes give fast, accurate spotting. ½-ton model lifts at 34 FPM. Hook suspension. ⅛ to 2 tons.

Lead Lifter Wire Rope Electric Hoists. ½ to 15 tons. Safe 24-volts at the push-button. Single and 2-speed control. Two automatic brakes. Lug or hook suspension; also with push, hand-geared or motor-driven trolley. Hi-hook model, too.



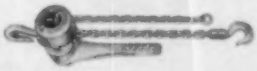
AIR HOISTS

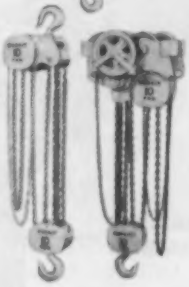
Budgit Air Hoist. Link and roller chain types. Pendant cord control. Speeds infinitely variable to 75 FPM. Rigid mount push trolley available. Safety hooks standard. ¼, ½ and 1 ton. Also Load Lifter Air Hoists with wire rope load line to 15 tons.

CHAIN BLOCKS

Budgit Chain Blocks. ¼ to 10 tons. Light, tough aluminum frame. 25 lb. pull on hand chain lifts 500 lbs. Fast action load brake makes lowering easy. Hook suspension or Army type trolley.

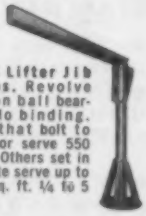
Tugit Lever-Operated Hoist. Light, compact, portable. Easy to operate even in close quarters — lifts or pulls at any angle. A fine maintenance tool. ¾ to 3 tons.





BUILD-IT-YOURSELF CRANE ASSEMBLIES

Budgit Crane Assemblies. Low-cost "build it yourself" kits to construct single girder cranes up to 6 tons and 30 ft. span without special tools. You buy I-beam locally to save more. Packaged electric bridge drive adds efficiency. Kits also for 180° swinging bracket jib cranes up to 4½ tons, 10 ft. reach.



Load Lifter Jib Cranes. Revolve 360° on ball bearings. No binding. Types that bolt to the floor serve 550 sq. ft. Others set in concrete serve up to 1500 sq. ft. ¼ to 5 tons.

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60L-10

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Shaw-Box Crane & Hoist Division • Muskegon, Michigan

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

For more facts circle 709 on Reply Card

DATA FILE

(Begins on page 304)

lations, a section on planning group replacement of lamps, cleaning. Champion Lamp Works.

For a copy circle 429 on Post Card

Lighting Specifications—Included in the 52-pp 1960 edition of the RLM Standard Specifications, are three new specifications for 1500 ma units: D-4 fluorescent semi-direct medium high mounting SD-3AL semi-direct aluminum and SD-3PE semi-direct porcelain enamel units. The book contains many upward revisions of existing specifications, and new specifications for aluminum reflectors and added provisions for inspection. The RLM Standards Institute, Inc.

For a copy circle 430 on Post Card

Paging System—Features and advantages of company's selective, wireless paging system are illustrated and described in Form S-150. Describes components and typical installations. Stromberg-Carlson Div., General Dynamics.

For a copy circle 431 on Post Card

Communication System—Featured in this bulletin is a transistorized communication system designed to provide communication between two or more persons or departments regardless of distance or surrounding noise conditions. Gai-Tronics Corp.

For a copy circle 432 on Post Card

PUMPS AND COMPRESSORS

Vertical Turbine Pump—Featured in 16-pp Bulletin 2400-B1 is a line of ultra high flow vertical turbine pumps. Design improvements, which result in broader coverage and higher efficiencies over wider operating ranges, are illustrated and described. Worthington Corp.

For a copy circle 433 on Post Card

Liquid Pumps—Heavy-duty liquid pumps for pumping paints and inks as well as other abrasive liquids are described in Data Sheet SP-507. Features are illustrated and dimensional data and specifications included. Viking Pump Co.

For a copy circle 434 on Post Card

Sizing Cooling Tower Pumps—Six steps to be taken in sizing pump and piping of any cooling tower installation are explained in 6-pp Bulletin CT-360. Provides selection charts, pipe sizing tables, drawings of installations. Bell & Gossett Co.

For a copy circle 435 on Post Card

Centrifugal Pumps—Bulletin 721.6 describes 33 sizes of horizontally split case single stage double suction centrifugal pumps with complete data on materials of construction, performance curves, dimensions, etc. Capacities from 200 to 6400 gpm for heads up to 425 ft. Goulds Pumps, Inc.

For a copy circle 436 on Post Card

Rotary Air Products—Features and advantages of company's rotary air products, including air motors, air compressors, and vacuum pumps, are detailed in 12-pp Catalog 660. Performance curves are included, along with tables of engineering data, dimensional drawings. Gast Mfg. Corp.

For a copy circle 437 on Post Card

Heavy Duty Compressor—Eight-pp Bulletin 350 describes and illustrates a horizontal, watercooled single-stage, heavy duty compressor designed to fit most compressed air applications. Photos, line drawings and cross-sectional views illustrate construction. Pennsylvania Pump & Compressor Co.

For a copy circle 438 on Post Card

Industrial Compressors—Oil-free heavy-duty industrial compressors are illustrated and described in 12-pp Bulletin A-92. Cutaway views show details of internal design and construction, and bulletin includes photos of typical installations. Joy Mfg. Co.

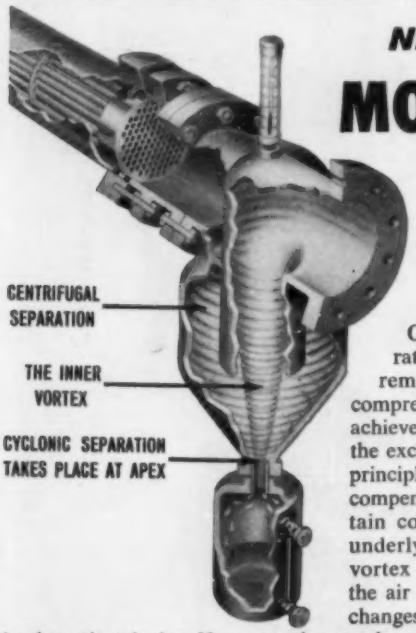
For a copy circle 439 on Post Card

To Speed Construction—Portable compressors, tractor compressors designed especially to speed work and reduce costs of construction are described and pictured in 8-pp Bulletin CG-15. Also presented are pneumatic air tools for use with the portable compressors. LeRoi Div., Westinghouse Air Brake Co.

For a copy circle 440 on Post Card

HEATERS, HEATING

Infra-Red Heaters—Bulletin CS-305 gives specifications, operating costs



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MOISTURE AND OIL REMOVAL?

(for your compressed air system)

Only the Adams CYCLONE Separator assures peak efficiency in the removal of oil and water from your compressed air system. Top operation is achieved from one-quarter to full load by the exclusive cyclone design. It is a proven principle of operation which automatically compensates for variation in load to maintain constant separating efficiency. The underlying feature is the inner cyclonic vortex formed within the unit itself by the air stream. The diameter of the vortex changes in proportion to variations in the load or air velocity. However, the angular air velocity, the RPMs, remain constant — and it is the angular velocity — the infinite changes of direction, which effect the separation of entrained particles at practically constant efficiency.

Remember, your aftercooler is only as effective as the separator which removes the condensed oil and water. Find out today how the Adams design can improve your oil and moisture removal efficiency. Write today for your copy of Bulletin 714.

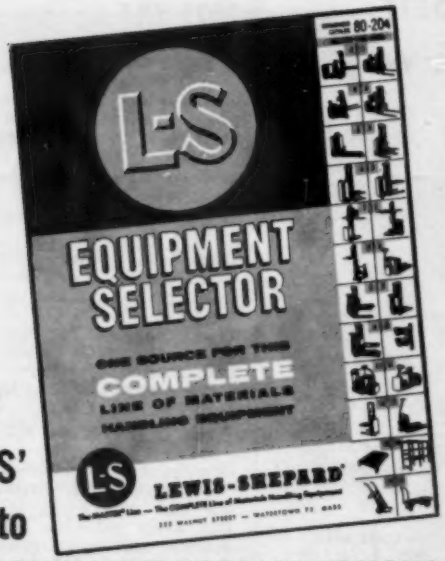
R. P. ADAMS CO., INC. 254 EAST PARK DRIVE BUFFALO 17, NEW YORK

For more facts circle 710 on Reply Card

LESCHEN WIRE PORTER ROPE DIVISION

H. K. PORTER COMPANY, INC.

For more facts circle 711 on Reply Card



HANDY BUYERS' GUIDE to COST-SAVING INDUSTRIAL TRUCKS

This handy reference describes Lewis-Shepard's complete line of "manually-operated," "intermediate" and "all-electric" equipment. Here is everything you need for a fully-integrated materials handling system. Write today for your free copy of L-S Condensed Catalog 80-204.

L-S LEWIS-SHEPARD®

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Varsol Spray Booth for Cleaning Small Parts

Designers, Builders and Installers of Paint Spray, Grinding, Cleaning, and Metalizing Booths to handle any industrial process. Our booths are built to the exact specifications determined by our complete engineering analysis of your job requirements.

Write for our Complete General Catalog

Gallagher-Kaiser CORPORATION

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For more facts circle 713 on Reply Card

Cutaway shows design features of the Sky-Blast

Free-Flow SKY-BLAST® Roof Ventilators are *WEATHERPROOF!*

Even if the rain comes down in buckets, there's no need for weather covers on SKY-BLAST roof ventilators. In operation, the powerful airstream keeps out snow, rain and sleet. At rest, butterfly dampers form a water-tight seal, won't leak a drop. With no interfering covers, more air is moved at less cost. Fumes are thrown high in the air to prevent re-entry into the building and to eliminate roof maintenance problems created by other types of ventilators. Wind velocity or direction can't affect performance. Heavy gage steel surfaces are hot-dip galvanized for real sou'wester protection. With patented, non-clogging rainshed, low wind guard, rugged base and condensate drain, it's always fair weather beneath a SKY-BLAST. Wind tunnel proven ratings to 78,000 cfm. Send for bulletin 680—PE

PROPELLAIR®

Div. of Robbins & Myers, Inc., *Springfield, Ohio*

MOVING AIR IS OUR BUSINESS®

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More heat with less coal... cleanup costs cut 75% with

Users report actual proof that OXI Crystals have cut coal costs substantially, reduced firebox and boiler cleanup costs up to 75%!

OXI Crystals increase boiler efficiency by getting rid of slag, firescale, encrusted carbon and soot *fast*. OXI oxidizes combustible deposits from firedoor to stack top. Get more heat and steam at less cost...write for complete information today! No obligation, of course.

Also ask about ***KOR****—world's most powerful fuel oil additive, and* ***SURFBLOW****—the floating boiler water skimmer.*

OXI CORPORATION 710 Box 485, Gary, Indiana

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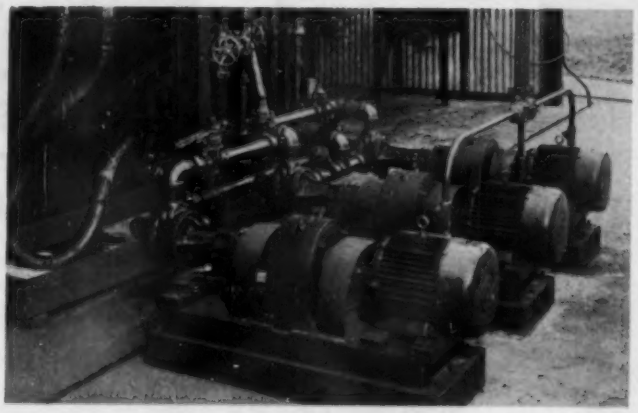
8 MILES OF PIPE — 80 PUMPS!



THE NEW Sherwin-Williams paint plant at Garland, Texas, uses 80 **VIKING PUMPS** and over 8 miles of pipe in processing upwards of 7 million gallons of paint and allied products annualy. **VIKING PUMPS** transfer solvents, oils and other liquids from tanks to processing buildings. **VIKINGS** are also used on portable units, blending machines and in numerous processing applications throughout the plant. **VIKINGS** pump heavy mixtures up to viscosities of 5000 SSU; jacketed, insulated **VIKING PUMPS** handle oil and rosin; finished varnish is pumped by **VIKINGS** through filter equipment; and **VIKINGS** move products up four floors to storage tanks. Mr. Willis R. Currens, general superintendent of the plant, states that the service and life of these **VIKING PUMPS** have been very good.

Just as a variety of **VIKING PUMPS** serve this Sherwin-Williams plant well in a variety of applications, so **VIKINGS** may be the very pumps to serve your needs, too. Whether you need a whole plant full or just one pump, **VIKING** engineers will be glad to work with you. For information, write for Catalog CZ, SP-507 **VIKING PUMP COMPANY**, Cedar Falls, Iowa, U.S.A. In Canada, It's **"ROTO-KING"** Pumps.

See Our Catalog in Sweet's Plant Engineer's File

For more facts circle 716 on Reply Card

DATA FILE

(Begins on page 304)

and typical applications for three portable gas-fired infra-red heaters. Describes principles and advantages of heaters that heat the workman and his tools but not the air. Perfection Div., Hupp Corp.

▲ For a copy circle 441 on Post Card

Infra-Red Heating—Bulletin Pc 1-59 gives specifications and dimensions on infra-red radiant heaters, including a hooded unit, which use any commercial gas for fuel and need no electrical power source. Describes construction features, control arrangements available. Panelbloc Div., Bettcher Mfg. Corp.

▲ For a copy circle 442 on Post Card

Heating and Ventilating—Company's "comfort curtain" principle of heating and ventilating is described in this 8-pp bulletin. Advantages are detailed and typical installations pictured through drawings and photos. Lennox Industries Inc.

▲ For a copy circle 443 on Post Card

Gas-Fired Heaters—Detailed information on gas-fired industrial type vertical delivery unit heaters is presented in 6-pp Bulletin IGV-660. Cutaway view showing internal details is included, as well as dimensional data and diagrams, performance data and specifications. Modine Mfg. Co.

▲ For a copy circle 444 on Post Card

Heating Coil Data—Two do-it-yourself work sheets relate to use of company's Thermo-Panel coil. Data Sheet No. 58 presents fitting arrangements for single embossed panel—a total of 40 variations. Data Sheet 59 gives fitting arrangements for double embossed panels—22 variations. Sheets contain drawings and dimensions for elbows, couplings, fittings. Dean Thermo-Panel Coil Div., Dean Products, Inc.

▲ For a copy circle 445 on Post Card

Heating, Air Conditioning—Featured in 20-pp Bulletin B-151A is company's line of air conditioning and heating equipment. Illustrated and described are air conditioning units, convector radiators, perimeter heating, hot water heating equipment, heating system controls, and unit heaters. Dimensions, and ratings are included Warren Webster & Co.

▲ For a copy circle 447 on Post Card

Hot Water System—How to provide hot water for the variety of requirements of an industrial plant without stretching the hot water system too far is the problem covered in this series of ring-bound bulletins. Various types of water heaters for commercial and industrial applications are illustrated. A. O. Smith Corp.

▲ For a copy circle 448 on Post Card

ELECTRICAL

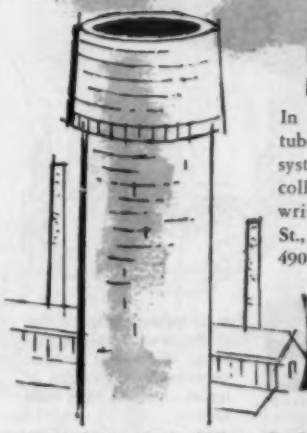
Single-Phase Motors—Bulletin 470-B describes integral horsepower single-phase motors, ¾ to 20 hp, in open, protected, totally enclosed fan-cooled and explosion proof frames. Bulletin

EXECUTIVE REPORT #27

When the Code Requires a "Clean Stack"

CLOTH FILTERS BEST

And Wheelabrator® Dustube® Collectors are the most efficient and economical way to filter with cloth. Dustube systems will collect dust and fumes regardless of concentration or particle size, with collection efficiencies above 99% by weight and 95% by discoloration test. By using appropriate synthetic filtering fabrics, Dustube systems are successfully filtering corrosive and abrasive particles, at temperatures up to 550° F in many applications.



DUSTUBE SYSTEMS OFFER THE MOST FAVORABLE BALANCE OF COST AND COLLECTION EFFICIENCY

In a wide variety of applications, Wheelabrator Dustube Collectors have proven to be the most economical system capable of delivering the required collection efficiency. For engineering data write to Wheelabrator Corp., 859 S. Byrkit St., Mishawaka, Ind. In Canada, P. O. Box 490, Scarborough, Ont.

WHEELABRATOR
DUST AND FUME CONTROL

For more facts circle 717 on Reply Card

4 good reasons for using Oakite Drycid®

—new dry powder—

for removing rust and scale

- **No more heavy carboys to handle**
- **No more waste of valuable storage space**
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These desirable "NO MORES" can be yours simply by switching from "carboy-shipped" liquid acid derustants and descalants to new, dry-powdered Oakite DRYCID shipped in disposable fibre drums.

Inhibited Oakite DRYCID removes scale-like deposits, iron sulphides, rust and other metal oxides. Oakite DRYCID does all this without filling the plant with fumes and odors. Try DRYCID today. Oakite Products, Inc., 31C Rector Street, New York 6, N. Y.

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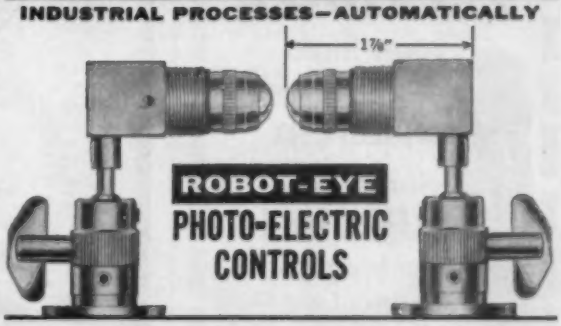
over 50 years' leadership in industrial cleaning — Est. 1909 — SCIENCE

Technical Service Representatives in Principal Cities of U. S. and Canada

For more facts circle 718 on Reply Card

count, inspect, control

INDUSTRIAL PROCESSES—AUTOMATICALLY



Transistorized and Tube **AMPLIFIERS**

Plug-in relays, receptacles for plug-in connection of lamps and cells. Additional Plug-in accessories include counters and time delays.

MINIATURIZED
Small, for "tight-spot" installation, yet rugged for long service. Accurate, for precise automatic control in virtually any industry.

INTER-CONNECTING
Plug-in terminals available for quick connection to any of a wide range of Amplifiers. This design enables you to select the most economical amplifier for your job requirements.

INEXPENSIVE
Standard Set P-5 is $17. Set P-5S is $21. Amplifiers start at $39.50. For complete data, write for Brochure VP-10.

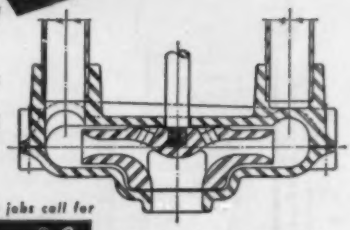
standard INSTRUMENT CORPORATION
657 BROADWAY, NEW YORK 12, N.Y.
In Canada: STANDARD INSTRUMENTS (CANADA) LTD.
767 Warden Ave., Scarborough • Toronto, Ontario

For more facts circle 719 on Reply Card

gritty, corrosive solution doesn't faze these Nagle® pumps

These two 5" type "SWOB" Nagle vertical shaft centrifugal pumps are giving excellent service in a Michigan metallurgical plant. They are designed to give years of service where ordinary pumps would give only months of service. All submerged parts are of corrosive and abrasion resistant materials. There are no bearings below the floor plate. No stuffing box to worry about. Pump entrance is at bottom of casing so that solids cannot settle around impeller when pump is not operating. Nagle "SWOB" pumps are available 1" to 8", capacities to 1800 GPM, heads up to 100'. Many of these pumps are cutting costs in chemical and metallurgical plants.

Nagle Pumps, Inc., 1267 Center Ave., Chicago Heights, Ill.



Tough jobs call for Nagle PUMPS FOR ABUSIVE APPLICATIONS EXCLUSIVELY

Nagle builds a complete line of vertical and horizontal shaft pumps for handling abrasive, corrosive or hot slurries or liquids—send for Nagle Pump Selector.

For more facts circle 720 on Reply Card

FLEXIDIZE

YOUR RIGID PIPELINE CONNECTIONS

Standard ALLFLEX MNH *flexible pipe connectors*

FROM STOCK IN STAINLESS STEEL MONEL • BRONZE

solve your pipeline flexation problem!

write, wire, phone today for your Allflex Datalog 611

ALLIED METAL HOSE CO.

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For more facts circle 721 on Reply Card

Next time get LESCHEN Wire Rope

LESCHEN WIRE PORTER ROPE DIVISION

H. K. PORTER COMPANY, INC.

For more facts circle 722 on Reply Card

DATA FILE

(Begins on page 304)

outlines company's "weatherizing" treatment which makes motors suitable for use in damp, dirty or corrosive atmospheres. Motor Div., Robbins & Myers, Inc.

▲ For a copy circle 449 on Post Card

Distribution Transformers—Dry type distribution transformers, single and three phase, are featured in 16-pp Bulletin 5A2-BL01. Wiring diagrams and detailed specifications are included. Acme Electric Corp.

▲ For a copy circle 450 on Post Card

Trolley Busway System—Three bulletins offer help on electrical installations involving cranes and hoists, assembly and production lines, test lines and other moving electrical equipment. Bulletin 60, 40-pp, covers 60 amp systems; Bulletin 70, 32-pp, covers 225-500 amp systems; Bulletin 75, 44-pp, covers 100 amp systems. Each includes special section on installation planning and procedure, mounting. Feedrail Corp.

▲ For a copy circle 451 on Post Card

Safety Mineral Insulated Cable—Bulletin S-2-60, 20-pp, describes cable properties, applications, installation procedure, construction and performance characteristics, electrical and mechanical properties and wiring specifications of mineral insulated cable recommended for hazardous locations. Mineral Insulated Wire Div., General Cable Corp.

▲ For a copy circle 453 on Post Card

Postage-free cards for ordering catalogs are on page 302. You may also use the cards to order literature mentioned in the ads.

Individually Enclosed Breakers—Featured in 8-pp Bulletin 4261-2B are individually enclosed-low-voltage power circuit breakers featuring visible break disconnect contacts. Selection chart, application data given. I-T-E Circuit Breaker Co.

▲ For a copy circle 455 on Post Card

Electrical Controls—Featured in this 80-pp Bulletin LO-11 is a line of electrical control equipment, including safety switches, service control, load centers, and accessories. Describes design and construction features, and includes detailed selection tables and case dimensions, wire tables. Cutler-Hammer Inc.

▲ For a copy circle 456 on Post Card

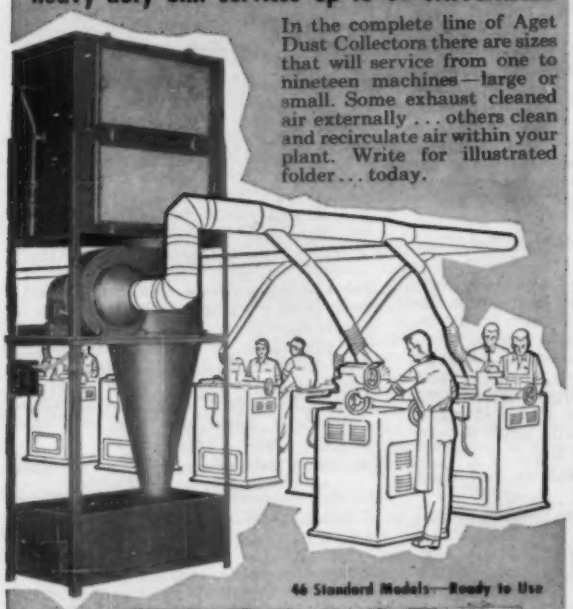
Power Panelboards—Bulletin VBP-470 contains 18 pp of information on features, design and operation of company's fusible Vacu-Break power panelboards. Contains circuit and dimension data, trim data, and suggested specifications on the units. Bulldog Electric Products Div., I-T-E Circuit Breaker Co.

▲ For a copy circle 457 on Post Card

just ONE DUSTKOP STOPS DUST

heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company
1388 Church Street • Adrian, Michigan

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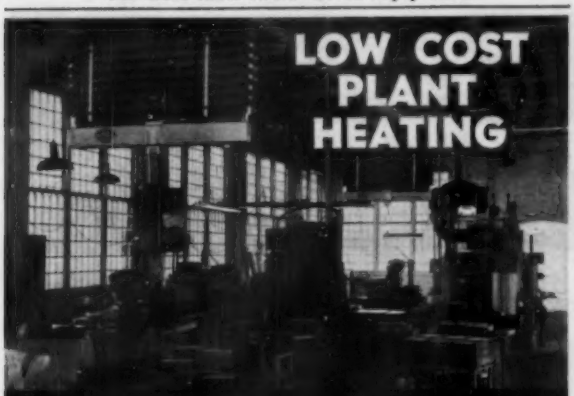
LOW COST PLANT HEATING



WITH INFRA-RED GAS FIRED PANELBLOC

Infra-red comfort heating is new and different, but thousands of users testify to its low cost and complete satisfaction.

Panelbloc heats like the sun. It generates infra-red energy in the 4 to 12 Micron range, and directs these waves downward, warming anyone and anything in its range. Panelbloc warms floors, machines and people.

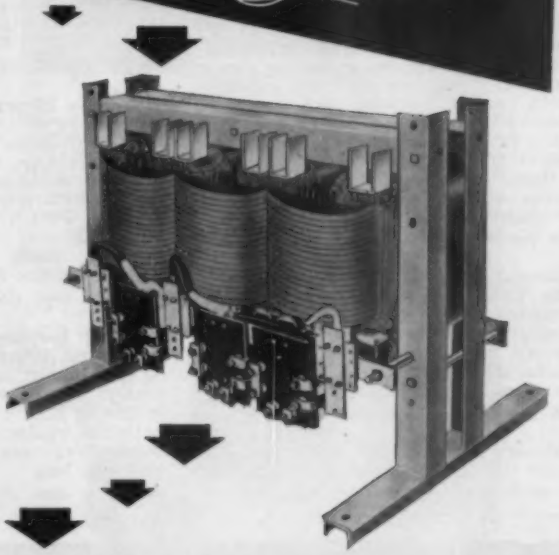
No moving parts, no fans or motors. No electrical connections needed. Automatic, clean and safe, Panelbloc carries AGA and UL approval.

Write for Bulletin PC 1-60-S

PANELBLOC DIVISION
THE BETTCHER MANUFACTURING CORP.
3106 W. 61 St. Cleveland, Ohio

For more facts circle 724 on Reply Card

IT'S WHAT'S INSIDE THAT MAKES THEM Quiet



If you're critical about transformer performance, examine the construction of Acme Electric continuous duty, dry-type transformers. You'll like what you see; sturdily constructed, grain oriented steel laminations, form wound coils, which are rigidly braced to resist the shock of heavy current surges. Ample spacing of components in a design that invites air circulation. High quality, insulating materials more than adequately withstand temperature rise for the respective classes of construction. Our many years of constructing Class H insulation transformers can be of value to you.

Compact, light weight, *quiet!* These are important features that have won the approval of plant engineers everywhere. Interior construction causes automatic air-flow cooling.
Write for catalog.

ACME ELECTRIC CORPORATION
3610 Water St. Cuba, N. Y.
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SAA 3410/1856

Acme ACME Electric
TRANSFORMERS

For more facts circle 725 on Repy Card

DATA FILE

(Begins on page 304)

Switch Wiring Diagrams—Bulletin 709 is a 36-pp booklet of typical wiring diagrams for across-the-line starting switches. Indexed and arranged for easy use, this booklet serves as a guide to some of the many ways in which this company's manual and magnetic across-the-line starters are used. Allen-Bradley Co.

For a copy circle 458 on Post Card

Testing Instruments—This 16-pp booklet features company's electrical testing instruments, including ohmmeters, ground testers, dielectric test sets, motor rotation tester, cable fault locating equipment, transformer turn ratio test sets, corona test equipment, frequency meters, tachometers, others. Includes photos and descriptions of each type, including chief features. James G. Biddle Co.

For a copy circle 459 on Post Card

Control Batteries—Twelve-pp Bulletin CP-539 describes batteries for control, switchgear and auxiliary power. Construction details are illustrated and described, and specifications are given as well as discharge curves. C & D Batteries, Inc.

For a copy circle 460 on Post Card

Battery Technology—Bulletin GB-1896 is a 36-pp handbook of technical instructions and engineering data on the care of motive power storage batteries. Covers all phases of lead acid battery theory, operation and maintenance. Provides basic information on specific gravity changes, charging cycles. Gould-National Batteries, Inc.

For a copy circle 461 on Post Card

Fuse Data—Illustrated and described in this Product Booklet 3 is company's line of fuses for a variety of applications. Covers dual-element cartridge fuses, renewable fuses and renewal links, one-time cartridge fuses, indicating one-time cartridge fuses, plug fuses and others. Economy Fuse & Mfg. Co., Div., Federal Pacific Electric Co.

For a copy circle 462 on Post Card

Aluminum Fittings—Catalog 59 contains 38-pp of data on aluminum fittings, including circuit breakers, cluster lighting, conduit bodies, connectors, couplings, dust-tight fixtures, elbows, fixture hangers, flanges, flood lighting, switch fittings, instrument boxes, junction boxes, motor starters, reducers, panel boards and others. Killark Electric Mfg. Co.

For a copy circle 463 on Post Card

Armored Locking Connectors—Illustrated and described in Bulletin NC-58 is a line of armored locking connectors for heavy duty applications involving high cycle tools and other portable equipment. Features and applications are detailed. Harvey Hubbell, Inc.

For a copy circle 464 on Post Card

Insulator Protection—Bulletin 4-218 explains how company's 5 compound applied to pole line insulators and electrical equipment bushings protects against excessive leakage, flashovers, and service interruptions in areas where atmospheres are contaminated by industrial dust or other particles. Dow Corning Corp.

For a copy circle 465 on Post Card

Electrical Equipment Digest—Electrical equipment illustrated and described in 160-pp Catalog Digest 142, includes load centers, circuit breakers, low voltage control, fusible service equipment and accessories, meter sockets and troughs, safety switches, panelboards, duct and fittings, starters. Square D Co.

For a copy circle 466 on Post Card

For Corrosive Spots—Sixteen-pp Bulletin 2699 on Condulets for corrosive locations, discusses corrosion-resistant properties of a variety of metals and finishes utilized. Charts show application of each. Also provides formal listings of Plast-A-Coat Condulets for hazardous and non-hazardous spots. Crouse-Hinds Co.

For a copy circle 467 on Post Card

Cable Support—Described in 28-pp Catalog 5912 are two types of cable trays or tube raceways, the ladder type and the basket small opening type, for cable, wiring and tubing support. Detailed dimensional data, transverse loading data, specifications, photos and diagrams are included. The Globe Co.

For a copy circle 468 on Post Card

GLOBE SAFE·GARD EXPANDED METAL

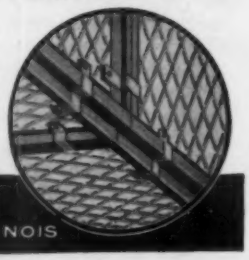
(FORMERLY HILMAR)

PARTITIONS with exclusive QUIK-ERECT patented fittings

...will answer all your enclosure problems

Here is the new, easier, simpler method of guarding conveyors and machines and for all in-plant partitioning. Shipped READY for erection, no cutting, drilling or welding required . . . these interchangeable expanded metal panels provide greater safety, cut overall costs, cover a wider range of use and require 85% less storage space.

EXCLUSIVE QUIK-ERECT SECTION CLIPS save much of the erection time formerly required. Proven successful in hundreds of installations, these Safe·Gard panels are of welded construction, give longer life, are more rigid and stronger than wire, will not ravel or fray.



Note enlarged detail showing SAFE·GARD Quik-Erect Clips securely joining the interchangeable panels.

Write today for more details or call your Globe (Grip-Strut) Distributor. Distributors in all principal cities, listed under "Grating" in your phone book.

114

PRODUCTS DIVISION | THE GLOBE COMPANY

4016 SOUTH PRINCETON, CHICAGO 9, ILLINOIS

For more facts circle 726 on Reply Card

1 man handles Sheet Steel Faster, Easier with a C-F LIFTER

C-F Lifters, under one man operation, pick up, carry and unload more sheet steel tonnage per hour than any other method – and at lower cost per ton. Wide carrying angles hold sheets securely – won't damage high grade sheets; tong action insures safe carrying; fast opening and closing adjustments of Lifter jaws permit shifting from one size pack to another in seconds. C-F Lifters are made in standard or semi-special models to handle from 2 to 60 tons.

Write for Bulletin SL-30 for specific examples of C-F Lifter operation and economy.

CULLEN-FRIESTEDT CO.
1317 South Kilbourn Avenue • Chicago 23, Illinois

For more facts circle 727 on Reply Card

FAST REPAIR, PATCHING FOR FLOORS...

- *Asphalt Mastic—Flooring Clay Emulsion Binder*
- *Latex Concrete Patch (small work)*
- *Latex Industrial Flooring (large work)*
- *Epoxy Flooring —for problem floors*

Keep factory and other work floors comfortable and accident free with these Flintkote Flooring Products—all are trowel finished.

For complete information on mixes, coverage, uses and speed of application write: The Flintkote Company, Industrial Division, 30 Rockefeller Plaza, New York 20, N. Y.

FLINTKOTE

Manufacturer of America's Broadest Line of Building Products

For more facts circle 728 on Reply Card

Quick removal of scrap — reclaiming cutting fluids from machine tool sump by Super Suction Cleaners is being done every day in hundreds of plants.

Floor maintenance is only one Super job — cleans all overhead dust catchers also—pipes, walls, etc.

SUPER SUCTION CLEANERS solve production problems, too!

Super heavy duty suction cleaners are giving an assist to so many production operations in all kinds of factories that many plants are buying them for production use exclusively.

These specialized Super heavy duty machines pay big dividends in cost saving where a powerful air stream for suction or blowing is required and for recovery, transfer or removal of wet and dry materials.

Supers Model BP-2 and RS-1 are specially designed and built for the infinite variety of production tasks they are called upon to do, as well as for general floor and plant cleaning.

Special adaptor covers make possible the use of motor and fan units of these Super cleaners mounted on a 55 gallon steel drum for massive materials handling.

Write for data and catalogs. Sold and serviced by responsible distributors in all principal market areas.

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In Canada: Plant Maintenance Equipment Co. Toronto, Montreal, Vancouver
SALES AND SERVICE IN PRINCIPAL CITIES

"Once Over Does It"
SUPER SUCTION SERVICE®
Power Suction Cleaners • Quality Floor Machines
SINCE 1911
"THE DRAFT HORSE OF POWER CLEANING MACHINES"

For more facts circle 729 on Reply Card

DATA FILE

(Begins on page 304)

Metal Raceways, Fittings—Catalog and Wiring Guide 22 contains 152 pp of data on surface metal raceways and fittings, multi-outlet assemblies, and lighting equipment. Included is a section on National Electrical Code as it affects company's product, including tables of capacities, as well as installation and application information and installation photos. The Wiremold Co.

▲ For a copy circle 469 on Post Card

BOILERS

Bent Tube Boilers—Design and operation features of company's bent tube boilers for power, processing or heating are detailed in 22-pp Bulletin VF-VS-2. Boiler sections of typical installations and principal data on each are included. Henry Vogt Machine Co., Inc.

▲ For a copy circle 470 on Post Card

Automatic Boilers—How Continental automatic boilers are designed to offer reliable and economical operation is discussed in Form BE 400. Stresses advantage of two-pass design; describes burners, controls. Boilers covered include 20 to 600 hp steam boilers, hot water and HWT boilers, for oil-, gas, or combination fuel. Dimensions tabulated. Continental Boiler Div., Boiler Engineering & Supply Co., Inc.

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Generators, Auxiliaries—20-pp Catalog SB 60, on steam generators and allied equipment, provides cross section views of major products to show design and construction. Standard and special boilers are included, also burners, Erie City Iron Works.

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Steam Generators—Advantages of company's steam generators designed to adjust to actual production needs are detailed in this 6-pp Product Bulletin C-731. Schematic diagram showing operating details is included. Clayton Mfg. Co.

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DUST, FUME CONTROL

Dust Collectors—Self-contained cabinet cloth-filter type dust collectors are illustrated and described in this 6-pp Bulletin 359. Design details included. Torit Mfg. Co.

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For Dust Collection—A collection of product sheets providing application suggestions and specifications on Dustkop equipment designed to solve a wide range of dust handling problems is provided in the Series 700 bulletins. Various models are described. Aget Mfg. Co.

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Dust Control Systems—Bulletin 104, 36-pp, on company's dust filters, gives detailed information about dust control systems and how to engineer them. Includes description of the Roll-Clean Dynaclone dust filter, as well as information on other dust filters. The W. W. Sly Mfg. Co.

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Dust, Fume Control—A wide range of industrial dust and fume producing processes that can be successfully controlled with the properly designed cloth or glass bay-type dust collectors is covered in 24-pp Buletin 562-D. Operating principles are illustrated. Wheelbrator Corp.

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Dust and Fume Control—Applications of company's dust and fume control systems in ceramic, foundry, grain, metal, steel and wood industries are illustrated and described in 50-pp Bulletin PE1-2. Design and specification data on centrifugal collectors given. The Kirk & Blum Mfg. Co.

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CORROSION CONTROL

Corrosion Resistant Equipment—Featured in 20-pp Bulletin CE-50 are charts to aid in selecting of corrosion resistant processing equipment, based on factors of chemical resistance, physical properties and economy. Materials covered include rubber-lined steel, hard rubber, rubber plastic, vinyls, Saran and polyethylene. Resistance charts cover acids, bases, amines, esters, hydrocarbons, ketones, phenols. American Hard Rubber Co., Div. Amerace Corp.

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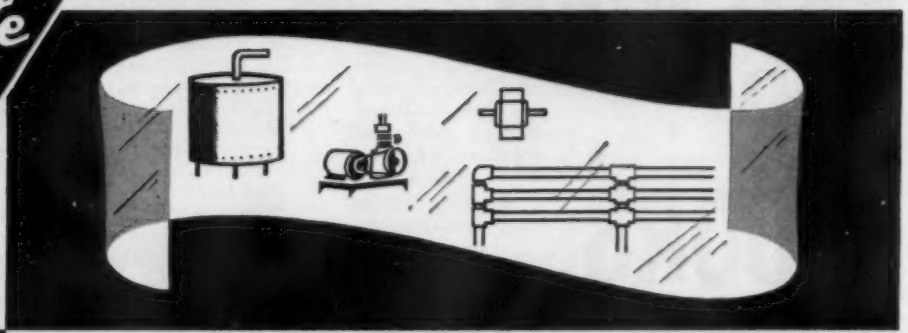

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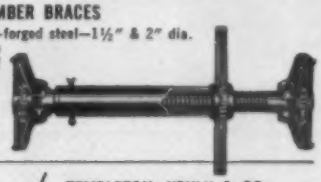

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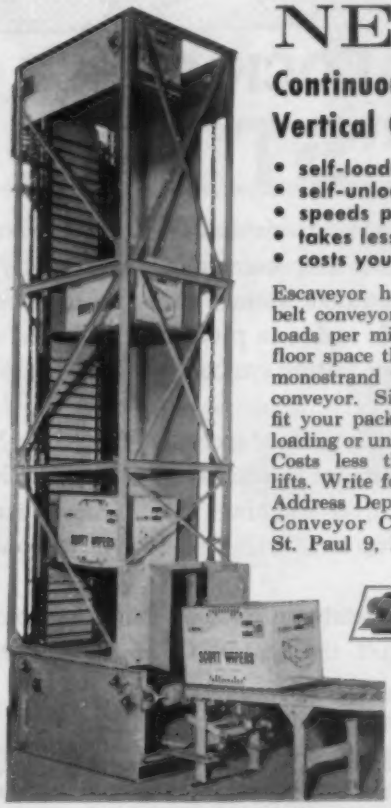

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DATA FILE

(Begins on page 304)

Corrosion Control Tips—Control of water problems in air conditioning system—scale formation and slime and algae growths—is discussed in Bulletin 596. Offers suggestions for the control of these problems through adequate, planned chemical treatment. Application information as well as control testing data are included. Betz Laboratories, Inc.

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Corrosion Resistance Chart—Over 150 chemicals and their recommended usage with ductile iron, iron steel, 316 and 304 stainless steel, Monel, brass, bronze, copper, aluminum and plastisol plastic are listed in Corrosion Resistance Chart J-CRC. Shows which gasket materials are needed for the various chemicals when Kamlock couplers are used, etc. OPW-Jordan Corp.

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OTHER EQUIPMENT

Industrial Stack—Detailed information on a permanent, low cost refractory smoke stack for commercial and industrial applications is contained in 8-pp Bulletin IS-32. Gives product informatoin, applications with boilers, furnaces, etc. VanPacker Co., Div., The Flintkote Co.

For a copy circle 483 on Post Card

Elastomer Coated Fabrics—Detailed information on synthetic elastomer coated fabrics is presented in this 12-pp bulletin. Physical properties and tests of the various synthetic fabrics, uses, specifications are covered. E. I. du Pont de Nemours & Co., Inc.

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For Cleaner Furnace—The use and application of Oxi Crystals to keep furnaces and the fireside of boilers free of slag, encrusted carbon, soot and fire-scale is described in a recent pamphlet. Oxi-Kor Corp.

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Product Guide—This 26-pp booklet is designed to show the wide range of products manufactured by the Company. It contains an alphabetical listing of the products, with reference to engineering literature available. Allis-Chalmers Mfg. Co.

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Industrial Cooling Towers—Design and construction features of company's industrial cooling towers utilizing the cross-flow principle are detailed in Bulletin G-60. Also describes double-flow towers. The Marley Co.

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Industrial Equipment—Featured in this 5-pp Bulletin is a line of equipment manufactured by this company, including such items as air release, can filters, capacitors, circulating lubrication systems, rate of flow controllers, dispensing outfits, filters, indicators, lubricating units, meters, oilers, pumps, valves. Bowser, Inc.

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Automatic Air Products—Featured in 22-pp Bulletin 157 are automatic air products, including separators, afterdriers, filtrators, filters, line drains, governors and kits, combinations, regulators, and lubricators. Advantages are detailed and operation described. Wilkerson Corp.

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Filters for Industry—Illustrated and described in this product bulletin are filters for a variety of applications in industry. Among those covered are liquid filters, intake filters, pipe line filters, dry and viscous panel filters, precipitators, Electro-Staynew mist collector, and a dual action filter. The Dollinger Corp.

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Why Rent Piling—Advantages of renting sheet piling are discussed in 24-pp Catalog 400. Illustrates typical installations, and typical pile arrangements for rectangular

and circular cofferdams, and includes dimensional data. L. B. Foster Co.

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Hinged Closures—One-man hinged closures with built-in safety features for vacuum, low and high pressure service are described in this product bulletin. Photos illustrate features, charts give dimensional specifications and cross-section drawings show design details. Tube Turns Div., Chemetron Corp.

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Turbine Type Blowers—Bulletin 142C describes company's turbine type blowers for sewage treatment and other agitation applications in chemical, food processing and other fields. Includes installation data, typical job specifications. The Spencer Turbine Co.

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Mechanical Press Brakes—Performance and construction features of company's all-welded mechanical press brakes for forming and punching work of every description are detailed in 48-pp Catalog 2023A. Clearances, dimensions and specifications, and tonnage requirement tables included. The Cleveland Crane & Engineering Co.

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Classifying Systems—This bulletin covers major advantages, industrial applications and design features of high efficiency classifying systems for efficient separation or dedusting of dry powdered materials. Includes details on operation, flexibility. Buell Engineering Co., Inc.

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Machine Mounts—A vinyl cork, sisal machine pad and an adjustable machine mount for reduction of transmitted vibration and no bolting of machine are described in this bulletin. Clark-Cutler-McDermott Co.

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Productive Maintenance Records—Visible signal controls for spotlighting maintenance schedules are described in this 8-pp bulletin on productive maintenance record systems. Various sets of forms used by business and industry are pictured. Acme Visible Records, Inc.

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Permanently Mounted Mixers—Fixed mounting propeller type mixers are featured in Bulletin B-521. Design and operation advantages are detailed and table of dimensional data included. Mixing Equipment Co., Inc.

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On Blast Cleaning—Illustrated and described in 24-pp Bulletin 1230 are blast cleaning and finishing methods and equipment. Features blast cleaning barrels, tables, descaling machines, as well as dust control equipment, abrasives and accessories. Pangborn Corp.

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Aluminum Coated Wires—Described in 6-pp Folder DH-537B are aluminized steel wire and wire products, including steel core wires, steel strand guy wire, overhead ground wire, toe wire, messenger wire, telephone wire, chain link fabric and barbed wire. Properties and applications listed. Page Steel & Wire Div., American Chain & Cable Co., Inc.

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Chain Link Fence—Catalog F-915, 64-pp, contains illustrated information on company's line of chain link fences of aluminum or steel for a variety of industrial, commercial and other applications. Detailed specifications and dimensional data are included, also photos of installations. The Colorado Fuel and Iron Corp.

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On Wire Cloth—"Which Inco Nickel Alloy Can Solve Your Wire Cloth Problem?" 16-pp, cites 23 case histories showing where use of Inco nickel alloys in wire cloth improved service at lowered cost. Lists standard weaves, more than 150 chemicals filtered with it, mechanical properties, physical constants. Buyer's guide of weavers included. The International Nickel Co., Inc.

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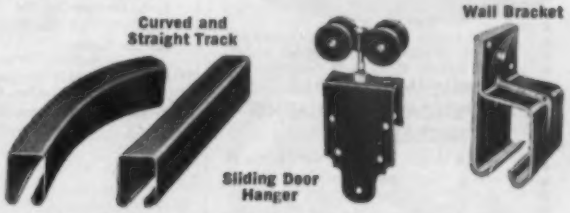

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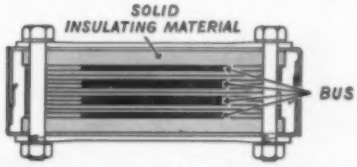

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